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22

PREFACE.

The fourth war-time Almanac has been prepared under stricter conditions of paper-rationing, which has further limited the number of its pages, both text and advertisement. Nevertheless, it is believed that both sections still fulfil the functions which the book has discharged for so many years. The one continues to provide photographers with information in daily need. The other now shows how the photographic trade of Great Britain has withstood the stress of three and a half years of war

Particularly as regards the text, space has been saved by omitting items in the "Formulæ" section which could well be spared; also by forgoing the inclusion of the list of Colonial photographic societies, from the majority of which, for self-evident reasons, particulars have not been forthcoming. Those secretaries who were able to answer our application will therefore understand why use could not be made of their replies. To them, and to all others who, in these difficult times, have contributed in any way to the volume, a sincere acknowledgment of indebtedness is here made.

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CONTENTS.

II Apparatus and Equipment

III Photographing Various Subjects

IV Negative Processes

MISCELLANEA OF NEGATIVE MAKING.

BY THE EDITOR

Whilst there is a continuance of the process of marking time in almost every branch of camera work except that of photography from the air, a useful purpose may be served by passing a glance over the present state of our knowledge and practice of the operations which are commonly concerned in the making of negatives. The field at its full is a wide one—far wider than could be adequately covered in an article many times the length of the present series of notes. Nevertheless the occasion seems an appropriate one to select for special consideration a few of the items which are of everyday importance in the handling of dry plates. Few of these items are quite new; the majority of them represent methods or formulæ which have come into use within the past five or ten years; in regard to all of them it may be said, without any great departure from truth, that they are subjects of particular interest to photographers of all classes. Certainly the inclusion of many of them in this article has been prompted by the repeated receipt at the "B.J." office of questions dealing with these specific points. Thus, while amateur photography, from the circumstances of the time, has had largely to be set aside for more pressing business and while professional photographers, from those same circumstances, have many of them had more than they could do with reduced or impoverished staffs, it may be hoped that readers belonging to both categories will find in the present review facts, comments, expedients and methods of which note may now be taken for use in the days when there shall be again the unrestricted opportunity for the enjoyment and advancement of photography.

TEMPERATURE IN DEVELOPMENT.

One of the things which has been brought into prominence during the past few years is the great effect which the temperature of the solution has upon development. That effect is the same whether you develop for a short time in a dish, for a longer time in a tank, or for still longer, with a much weakened developer, according to the so-called "stand development." With a developing solution

which contains only one developing agent, for example, amidol or pyro, the effect of low temperature is to prolong the time of development; of high temperature, to shorten it. That is to say, you are a longer or a shorter time in obtaining a given degree of contrast or vigour in the negative. And if the departure from a normal temperature of 60 to 65 degs. F. is great, it is not likely that by developing for however long or short a time you will get the same result as by working at the normal temperature. Moreover, the effect of temperature is considerable, varying with different developers. For example, an Azol developer which at 65 degs. requires 2½ minutes for correct development, at 50 degs. requires 4 minutes. Thus whatever system of development you use—by time or by judging from the appearance of the negative—a proper regard to the temperature of the developer must conduce to regularity of working.

Still more is this the case when the developing solution contains more than one actual developing agent. For this reason—that the effect of higher or lower temperature differs in degree with different developers. Two such commonly used developers as hydroquinone and any developer of the metol type such as Monomet are a case in point. Hydroquinone tends to fall off greatly in energy as the temperature falls, and thus if the developing solution is used at a temperature which is below, say, 50 degs., the effect of the hydroquinone is largely removed and the developer tends to become one much softer in working.

Keeping Developer at Temperature.

The importance of having the developer at a given temperature being as mentioned in the previous paragraph, it is necessary to remind the reader that it will not do to take it for granted that because the solution in the graduate is, say, 65 degs., therefore it remains at this temperature during the period of development. Yet many people seem to think it quite sufficient, when working in a chilly dark-room, to add a little hot water when making up the developer and to satisfy themselves that the mixture shows 65 on the thermometer. It is not recognised that the temperature constantly falls or rises according as the temperature of the room is lower or higher. The greater the difference between the temperature of the solution and that of the room, the more rapid is the change in the temperature of the developer. If you work on these lines it is impossible to expect any satisfactory results in the way of uniformity when developing for a given time. You must choose between one thing or the other—either use the developer at whatever temperature your dark-room happens to be (putting up with the prolonged time of development if it is chilly), or on the other hand mix your developer with hot water to yield a normal temperature of 60 to 65 degs., and at the same time take measures to keep it at this temperature during development.

For reasons already stated the latter system is the better of the two, and really the means which are necessary to maintain the developer, in dish or tank, at a given temperature for a time of

from 10 minutes to half an hour are simple enough. You may put the developing dish in a large dish containing water a few degrees above the temperature which you want to maintain. A better form of the same expedient is to use a tin container of warm water on, or rather in, which the developing dish can be stood. The reader may recall in a past volume of the "B.J." the drawing of such a container shown some years ago to a London Photographic Society by Mr. T. E. Freshwater. But if there is a spare gas connection in the dark-room the handiest plan is to use a small ring burner, placing the developing dish upon a stand which raises it a foot or so above it and so allows of the very moderate increase of temperature which usually is necessary. The coldest of dark-rooms will rarely call for more than a burner turned down to the blue: and from the feebleness of its illuminating power and its position immediately below the dish there is no danger of fogging plates lying in the latter. An electric lamp with a ruby bulb can be used with equally good effect; a small oil lamp, if contained in a light-tight box such as a biscuit tin, provided with ventilating holes at top and bottom, will serve the same purpose, and even the dark-room lamp itself may be pressed into service to the same end, though with less convenience by rigging up a shelf above it to take the developing dish or tank.

The opposite difficulty, namely, that of bringing the temperature of the developing solution down to a reasonable normal, is one which troubles us but little in the British Isles. In hotter countries the use of ice for cooling the developer itself and the water in which the dish can be placed is about the only really satisfactory means of combating excessive temperature, but mention should be made of the plan (often adopted in tropical countries by explorers and others who cannot get ice) of doing all development of plates or film in the very early hours of the morning, when a supply of stored water often falls to a reasonable temperature.

TANK OR TIME DEVELOPMENT.

These terms are still rather loosely used, but when one speaks of development by time or tank it is usually understood to mean the system of putting the plates into a developer of a given formula and temperature, letting them stay in it for a time previously found, by the worker himself or by the supplier of the developer to be a suitable one, and then taking out the whole lot of plates without regard to the appearance of the negatives. A question which the beginner, and indeed the professional photographer, often asks is whether this system is as good on the whole as the time-honoured practice of judging the appearance of each negative by examining it in the dark room before development is stopped. There is little doubt that the answer is that for the purposes of those who have not had years of practice in the development of negatives, the time or tank system yields a better aggregate of good negatives than does that in which everything is left to personal judgment. And this is said with regard to the fact that exposure of the plates may err in the direction of being too much or too little. With plates which have been correctly

exposed development for a scheduled time gives as good a negative as can be made, once the time for a particular plate at a given temperature has been ascertained, and providing, of course, that the developer actually is at that temperature during the whole time it is acting. And then as regards under-exposures, the time system is probably better than the method of looking at the plate as it develops. On the latter system nine people out of ten will keep the plate too long in the developer in the hope of "forcing out" detail which the exposure has failed to record. The result is that the more exposed high-light parts of the negatives become excessively dense, and you get the almost unprintable "soot and whitewash" negative. On the other hand, the time system automatically cuts out this over-development. The negatives will still look pretty hopeless, but for purposes of printing they are no worse than those which have been developed for a longer time, and often can be made into quite decent printers by intensifying with a single-solution formula such as uranium or iodide of mercury.

And for over-exposures the time system provides a corresponding advantage in that it ensures the continuance of development for a reasonably full time. That is what you want to do with the over-exposed plate which comes up quickly in the developer and soon gets its flat image covered with a general deposit of density in which details are lost. In these circumstances the tyro in development is apt to think that everything will be spoilt by continuing development: the fact is that the longer you develop the more you remedy the defect of flatness which has had its cause in the over-exposure of the plate. The scheduled time which a plate will get in the developer according to the regular tank system may not be as much as a case of over-exposure could do with, but on the average it is probably longer than it would get at the hands of the tyro developing in an open dish. Thus it yields a negative which often will prove a good deal better than it looks in printing, though calling, of course, for a great degree of exposure whatever printing paper is used. And it must not be forgotten that a negative of this kind is susceptible to a very considerable degree of improvement by treatment with a reducer such as hypo-ferricyanide which will make it a quicker printer without affecting to any appreciable extent the extra contrast which has been got in it by the full development.

Time Development with and Without a Tank.

So the amateur in photography should gather from what has just been said that there is, on the whole, a balance of advantage as regards aggregate quality of negatives in the use of the time system of development, and thus the economy of time and working space in dealing with a number of exposures can be set down as a net asset of the system on the credit side of the account. A few words may therefore be said about tanks and developers. The choice of a tank is governed in one great respect according to whether it is wished to develop by time in an ordinary dark-room or to dispense with the dark-room. In the latter case, obviously it is necessary to have a light-tight tank, into which the plates are loaded by means of

a changing bag or in a perfectly darkened room, and from which, after running off the developer and giving a rinse or two in water, they are removed to a fixing bath or the fixing solution poured into the tank itself. Undoubtedly this system has much to attract many amateur photographers who are unable to provide themselves with the facilities of even a most primitive dark-room, and there are several types of tank upon the market which allow of its being adopted. On the other hand, the choice is wider if the tank does not require to be light-tight—*i.e.*, when the plates are handled entirely in the ordinary red light of the dark-room.

But, whichever system is chosen, there are certain other features of the developing tank which should on no account be overlooked. The chief of these is that there should be the means of moving the plates in the tank or of keeping the developer in occasional movement. If the plates are left for the whole time in a stagnant developer there is the liability to defects to which special reference is made in a succeeding paragraph. One way of avoiding these is to have the plates contained in a loose rack, which can be moved up and down every now and then during the period of development. This, obviously, is only for a tank which is handled in the dark-room. Another means, applicable to tanks which are used in daylight, is the provision of a flat water-tight lid, so that the tank can be stood either one way up or the other, and by the reversal of its position, say, four or five times during fifteen or twenty minutes' development, can secure the necessary movement of the developing solution. One system is as good as the other, but the movable rack has the advantage that it can be applied to tanks of glass, wood, or porcelain, any of which will outlast many times a tank of metal.

Another feature to be desired, though often disregarded in tanks on the market, is a decent distance between the plates. Makers seem to perceive a virtue in designing the grooves of developing tanks as close to each other as possible, doubtless for the purpose of reducing the cubical capacity of the tank, and thus representing it as requiring a correspondingly small bulk of developer. But this aim at economy has its drawback. It means that between each plate there is a very small quantity of developing solution, a good deal less than would be used in ordinary dish development—and developer, too, which is usually a third or a quarter of the strength of that employed when developing in the ordinary way in dishes. Hence the conditions are favourable to exhaustion of the developer which is in contact with the plate, a state of things which is one contributory factor to the defects already referred to as arising from lack of movement of plates during development. A quarter of an inch between plate and plate is not a bad standard for the minimum separation. If this is provided by the rack, then the user may be well advised to place a couple of plates back to back in each pair of grooves. Many small plates are (or rather were) of sufficiently thin glass to allow of this being done and the developing capacity of the tank just doubled. But it does not need any demonstration to make it clear that if this same practice is followed in the case of a rack which provides the narrowest separation of plate from plate the conditions for exhaustion of the developer are intensified.

I believe that this has much to do with the trouble in the way of markings on tank-developed plates, which is the experience of some.

Just a word should be said to the effect that there is no reason why the tank system of development should not be adopted when developing in a dish. So long as the developing time of the solution is known, and care is taken in adjusting and maintaining its temperature, it doesn't matter whether plates lie in a horizontal or vertical position. In developing a goodly number of small plates in a large dish, they can be prevented from slipping over each other when the dish is rocked (very necessary, that it should be rocked) by temporarily fixing them to the floor of the dish with little dabs of Plasticine.

TANK DEVELOPERS.

A request which is very commonly made is for a formula for tank development which will develop such-and-such plates in such-and-such a time. Unfortunately, it is not possible to give information of this kind in the definite shape, which, usually, the inquirer desires. Practically it may be said that any well compounded developer, as used for dish development, serves well for development by time or tank when diluted with three or four times its bulk of water. But the very considerable differences in the speed of development of different plates make it a matter of impossibility to supply precise data as to the time of development. Moreover, the requirements of the worker in the matter of freedom from stain in the negatives have also to be taken into account. Generally speaking, a normal formula, which is sufficiently free from stain when used in the ordinary way, calls for an additional dose of sulphite or metabisulphite when using it in a diluted state for tank development. However, it may serve some useful purpose to place here two formulæ for tank development, one requiring to be compounded at the time of use, and the other having considerable keeping powers, and being capable of strengthening as time goes on. The first of these is an amidol formula, due to that well-known worker, Mr G. T. Harris:—

Soda sulphite	500 grs.	28 5 gms,
Potass. metabisulphite	100 grs.	5 7 gms.
Potass. bromide.	10 grs.	0.6 gm.
Amidol.	50 grs.	2 8 gms.
Water ......, ...	40 ozs.	1000 c.c.s.

With this formula a time of development for good printing density averaged about ten minutes.

The second formula is one worked out by Mr. W. G. Cullen, of the technical staff of Messrs. Kodak Limited. It is a variation of the well-known "B.J." pyro-soda, owing its keeping properties to the combination of sulphite and metabisulphite:—

Soda sulphite	10 ozs.	280 gms.
Potass. metabisulphite	1¼ ozs.	35 gms.
Pyro	1 oz.	28 gms.
Soda carbonate	3¾ ozs	105 gms.
Potass. iodide	4 grs.	0·25 gm
Water .. ..to	140 ozs.	4000 c.c.s.

The sulphite is dissolved in about 60oz. of hot water, the meta-bisulphite added, and, when dissolved, the solution boiled for a short time. Although it gets dark and muddy, the developer continues to yield negatives of ample printing density in a time of development of about twenty minutes. If it is found to be becoming slower than this, it is reinforced by adding pyro in about the proportion of 1gr. per ounce of the working bath.

But in all such systematizing of development by time the worker can help himself better than anybody can help him. If he will spend a box or two of plates on exposures upon a well and brightly lighted subject, containing some parts in actual sunlight, and also a little clear sky, a little experiment will tell him the time of development (at a given temperature) suitable for the degree of vigour in the negatives which he prefers. If this time is too long, say much over twenty minutes, the developer requires to be made up with less water; if too short, say anything under ten minutes, water requires to be added. While upon this point, it seems worth while to remark upon the very little interest which the manufacturers of dry plates have taken in development of plates by time. While many makers overload their instructions with a superfluity of developing formulæ, very few of them give any definite data which the user of their plates can take as a starting-point in developing by time. It appears not to be realised that a very great number of amateur photographers and a considerable proportion of studios engaged in the portrait business develop plates in tanks by time. We may hope that before long manufacturers will display their recognition of this fact by including, as they could readily do, for each batch of emulsion a memorandum which would tell the user sufficient to enable him to develop by time with very little adjustment of his working conditions. As most manufacturers of plates are makers also of papers, such a circular might well be of the following form:

Times for Development at Various Temperatures of A and B.'s Medium, Rapid, and Ultra Plates to Density Suited to A and B.'s Bromide, Gaslight and Soft Gaslight Papers.

Temp. °F.	Medium.			Rapid.			Ultra.		
	Bromide.	Gaslight	Soft gaslight	Bromide	Gaslight	Soft gaslight	Bromide.	Gaslight	Soft gaslight
45									
50									
55									
60									
65									

Development times at these temperatures and for negatives suitable for the printing papers indicated would give photographers

generally a pretty useful indication by which to employ a maker's tank developer formula according to their special requirements.

LINE MARKINGS IN DISH AND TANK DEVELOPMENT.

In a previous paragraph reference has been made to the necessity of preventing the developing solution from remaining still during the whole period of development, and, further, of so overcharging the tank that the developing solution approaches exhaustion. Simultaneous neglect of these two precautions is the cause of the characteristic marking on negatives, to which years ago the name "the Mackie line" was given. This line, or rather narrow band, takes the form of an edging of dark deposit extending along the frontier, which separates the image of a comparatively dark part of the subject, from one which is of comparatively light tone. The band runs along the margin of the latter area. It is easy to understand how in developing, either in a dish or tank, this effect is produced if the developer is quiescent, and if at the same time its strength is such that by its action upon a fairly fully exposed part of the emulsion it becomes locally exhausted. The why and wherefore of the occurrence of this marking can perhaps best be made clear by tracing in a series of stages what goes on when a plate containing a fairly strongly exposed portion of emulsion lying against another portion, which is almost unexposed, is developed under these conditions. We may set it out as follows.—

	A		B
In subject............	Light tone	against	... Very dark tone
On plate	Strongly exposed portion	against	... Almost unexposed portion
Developer, if still	Soon exhausted......		Unexhausted

As result of developer diffusing from B to A over frontier line dividing the two.

	A	B
In negative	Band of extra density encroaching on area of tone A	Unaffected
In print	White band encroaching on area of tone A	Unaffected

This effect is met with when developing plates without rocking, and particularly with a small quantity of weak developer *in a dish*, but it is more commonly particularly marked in tank development as a result of diffusion taking place downwards in the gelatine film. Hence we get the occurrence of dark streamers marking the flow of developer from comparatively non-exposed areas downwards across other areas of medium density. It is the band effect in another form. The moral from this phenomenon is to keep the developer moving, especially during the first minute or two of development, because once the band or streamers of extra density has started, it will steadily gain in depth as development proceeds.

OTHER TANK MARKINGS.

A word ought to be said here also on the occasional—fortunately, very occasional—occurrence of markings on tank-developed plates. Sometimes these take the form of a network of reticulation over the whole surface of the plate; at others, they are splotches of density, as unaccountable as the more uniform foliage marking. And to cap the mystery it is usually found, in the rare instances when one or other of these markings occur, that they will afflict one or two only out of a dozen identical and identically exposed plates in the same tank. There does not seem to be any explanation forthcoming of these defects, which, it [illegible] said, are sufficiently rare as not to deter anyone from availing himself of the convenience and efficiency of the tank system. Other markings are less mysterious. For example, the scum-like marking on the edges of plates, and sometimes occurring only on one or two out of a dozen in a tank, has been connected, by a correspondent in the "B.J.," with the insertion of the dry plates into [illegible] of which some of the grooves are wet and others dry.

FIXING.

One of the things which, within the past few years, we have come to realise is that the complete fixation of negatives, as a factor in the avoidance of impermanence from staining or fading, is a much more important thing than the washing out of hypo. If a negative is fully fixed, it must be an abominably scamped washing that will lead to serious harm; if it is not fully fixed, no amount of washing will do it any good. What it amounts to is this: We don't know what amount of hypo may safely be left in a negative without prejudicing its permanence or upsetting after processes; we do know that any quantity whatever of insoluble hyposulphite of silver (the compound which results from incomplete fixing) means stains on the negatives sooner or later, and all kinds of trouble in intensification. And if I may step aside for a moment from the subject proper of this article, I would insist once again on the still greater importance of complete fixing for prints, and particularly in the case of papers produced during the period of the war, many of which are more difficult to rid of silver compounds by the hypo bath. Once again let the reader note the very great advantage of passing all prints through two hypo baths in succession, the second, one which is reasonably fresh.

Another thing about fixing which deserves to be more widely emphasised than it is, is that the most rapid and most economical fixing bath (with an exception to be referred to in a moment) is a plain solution of hypo without the addition of acid, alum, or anything else. Such a bath fixes more rapidly, and a given quantity of hypo goes much further. Some years ago MM Lumière, as the result of very careful comparative tests, found that hypo in solution by itself would fix roughly twice as many plates as when compounded in a bath with acid or alum. This is a point for all amateur photographers to note, and particularly now that hypo.

like most other things, costs us considerably more. For many purposes the making of negatives on films and plates, fixing of bromide and other papers—there is no occasion to make use of an acid bath; and the plain hypo crystals are dissolved as readily and quickly as the powder acid-hypo preparations which it would seem are very largely used by amateurs for fixing both negatives and prints.

A Quick-Fixing Bath.

In reference to the exception just mentioned, it may be useful to record here the formula for a fixing bath which *does* work more quickly than ordinary plain hypo, though whether it is more or less economical of hypo it is not possible to say. At any rate, the formula, which is the outcome of experiments made a year or two ago by Mr. Welborne Piper, has a useful application for rush photographic work, such as that of portraiture at while-you-wait studios, photography at bazaars, and such like. It is:—

Hypo..	4 ozs.	200 gms.
Ammonium chloride (sal ammoniac)	½ to 1 oz.	25 to 50 gms.
Water	20 ozs.	1000 c.c.s.

This bath fixes a negative in about half the time required by one of the same strength in hypo.

The Acid Fixing Bath.

Still there are those who prefer to use a bath which keeps reasonably free from colour, as long as it retains its fixing powers and, with pyro developer, yields negatives of corresponding freedom from yellowness or stain. The fact that fixing baths of this kind are generally known as "acid" is perhaps the reason why many photographers come to think that addition of a little acid, such as acetic or citric, is quite a good method of compounding the bath. Without going into the chemistry of the acid fixing bath, let it be said that it is not. An acid bath is correctly made only when the effective acid is sulphurous acid, and for making a bath on these lines there is no better formula than one which has been published for years past in this Almanac, and which, on account of its reliability, deserves to be specially set forth. This is:—

Hypo.......	4 to 6 ozs.	200 to 300 gms.
Potass. metabisulphite	½ oz.	25 gms.
Water	20 ozs.	1000 c.c.s.

A fixing bath made in accordance with this formula will keep almost colourless as long as it fixes, and will not become muddy in use from deposition of sulphur.

Fixing-Hardening Baths.

For ordinary work, as I have said, there is for the most part no particular reason for adding anything to the hypo solution. The modern dry-plate as regards freedom from tendency to frill or blister is altogether different from the plates of the early days of gelatine

emulsion. If it is necessary to use a fixing bath which also tans the gelatine film, it is generally on account of the user wishing to dry negatives quickly in the heat, or by reason of high climatic temperature, rarely experienced in these islands, but common with photographers in many other parts of the world. Therefore I include here some notes on fixing baths of this kind since the making up of such formulæ appears to give difficulty to many. Perhaps one cause of this is the different degrees of quality of ordinary alum. On this account it is better to employ chrome alum in making up a fixing-hardening bath. The formula on a later page in the section "Fixing and Hypo Eliminators" cannot easily be improved upon, but it is necessary that the four substances—sulphuric acid, sulphite, hypo, and chrome alum should be separately dissolved and mixed in the order there prescribed. In particular, neither the acid nor the alum should be brought in contact with the hypo until the sulphite is thoroughly mixed with the latter. Possibly those who have observed the order, and still have obtained a muddy bath, may find a key to their failure in the incomplete solution of each separate chemical in its lot of water. For this reason it is just as well to use quite hot water for dissolving each (with exception of the sulphuric acid), and to mix them when cool.

An alternative to this formula, and one which I give for the benefit of those who prefer to use ordinary alum, is to make a separate solution (hardener), which can be added to the ordinary fixing bath when and as required. This stock solution, which will keep for any reasonable time, is

Soda sulphite cryst.	4 ozs.	200 gms.
Acetic acid (glacial)	3 ozs.	150 c.c.s.
Alum....	4 ozs.	200 gms.
Water	20 ozs.	1000 c.c.s.

The hypo bath for use in conjunction with this hardener should be of full strength, viz., 5oz. hypo in 20oz. water, equivalent to 250 gms. per litre. Then, to make a hardening fixing bath 2oz. of the above hardener solution are added to 20oz. of the hypo bath, or 100 c.c.s. to a litre of the hypo bath.

While upon this subject of hardening fixing baths, a formula may be quoted, for the reason that several correspondents have written describing it as the most satisfactory of hardening fixing formulæ. It is one worked out some ten years ago by the Italian experimenter, Professor Namias, and differs from most others in dispensing with acid :—

Sodium acetate	½ oz.	25 gms.
Hypo.	5 ozs.	250 gms.
Water	16 ozs.	800 c.c.s.

After dissolving the hypo. and acetate, addition is made of—

Chrome alum	65 grs.	7·5 gms.
Water	4 ozs.	200 c.c.s.

The acid in this formula is really provided by the chrome alum itself, or rather by the action of the chrome alum upon the sodium acetate. In this way a sufficient hardening action is produced with a smaller proportion of the alum.

Extra-Hardening Fixing Baths.

Within the last few weeks, while this volume has been passing through the press, a paper from the Eastman Research Laboratory by Mr. J. I. Crabtree has made notable addition to our working knowledge of hardening-fixing baths in the shape of formulæ specially for the use of those in tropical countries, where temperatures from 75degs. to 100degs. F. are commonly experienced. This Almanac coming into the hands of many photographers situated in tropical latitudes, it may be a service to bring these formulæ before them. For extremes of temperature up to 95degs. F. it is found that a fixing bath, containing a considerable proportion of formaline, hardens the gelatine film sufficiently to allow of its safe washing and drying. This bath is:—

Hypo	5 ozs.	250 gms
Soda sulphite anhydrous	1 oz.	50 gms.
Formaline	2½ ozs. (fl)	125 c.c.s.
Water	20 ozs.	1000 c.c.s.

The hypo should be dissolved first, then the sulphite and the formaline added Although this bath has not the keeping qualities of an ordinary fixing bath, it was found to retain its properties satisfactorily for a week or more at the temperature of 100degs. F. The formaline, which is the ordinary commercial liquid sold under this name, and containing about 40 per cent. of formaldehyde, can be used in somewhat smaller proportion, say 1oz. 6dms. per 20oz., equivalent to 90 c.c.s. per litre.

But where the working temperature is not excessively high, say not above 85degs. F., a special fixing-hardening bath compounded with chrome alum is found to be equally effective and is, of course, free from the objection of the irritating formaldehyde vapour, which is discharged from a bath made up with formaline.

Hypo	4 ozs	200 c.c.s.
Sodium sulphite, anhydrous	350 grs.	40 gms.
Chrome alum	700 grs.	80 gms.
Acetic acid, glacial	25 minims	2·5 c.c.s.
Water	20 ozs.	1000 c c.s.

In making up this bath the sulphite and chrome alum should be dissolved together in part of the water. the hypo, dissolved in another lot. then added, and finally the acetic acid.

Washing and Hypo-Destroyers.

During the past twelve months two papers, one by A. Vincent Elsden and another by A. W. Warwick, have drawn attention to what may be called the physical analysis of the process of removing hypo by washing from plate and film negatives. It may be useful

therefore, to interpret the general facts disclosed by the results of these two investigators in terms of the everyday manipulation which we adopt in washing negatives. Here I recall an article written many years ago by, I think, Mr. C. F. Townsend, entitled "Washing, i.e., Soaking." It is to be hoped that the wording of the title did not mislead the superficial reader into assuming that by soaking negatives in a dish of water the hypo is thereby removed. Nothing in fact could be further from the intention of the article, which was to emphasise that washing is, or should be, a series of soaks in water with the soak-water drained away completely after each. That is the principle upon which Messrs. Elsden and Warwick have gone, but they have proceeded further, and by actual measurements of the quantity of hypo extracted at each stage of a series of short soakings have shown the very complete removal of the fixing salt, which is possible with a quite limited quantity of water. They have, in fact, shown that the law governing the removal of soluble matter from insoluble material containing it—a law which has been familiar to chemists for a generation past—likewise governs the removal of hypo by water from emulsion films, or nearly enough to make no difference in the way of establishing the lines which should be followed in ordinary photographic work. Perhaps the character of this law can best be shown (approximately) by taking a concrete example. Suppose we have a quarter-plate negative fresh from the fixing bath. Including the hypo solution clinging to the glass side, as well as that contained in the gelatine film, it carries about 10 grains of hypo dissolved in about 50 minims of water. These figures may vary according to the strength of the hypo bath and the thickness of the emulsion film, but, broadly speaking, they are not very wide of the mark. At any rate, imagine the 10 grains of hypo distributed, partly on the glass side and partly in the film itself, in 50 minims of water. Now, suppose we immerse the plate in nine times the volume of water which contains the hypo, that is . 450 minims, practically one ounce, making 500 minims in all. Allow some little time to elapse, and the hypo, by ordinary natural processes, aided by rocking of the dish, will distribute itself uniformly through these 500 minims. Thus the result of pouring off the water from the plate is to leave as before 50 minims of solution, but containing only one-tenth the quantity of hypo, the remaining nine-tenths passing away with the bulk of the soak-water. In other words, one grain of hypo is left on and in the plate, and nine grains has been got rid of. We start again on that one grain, and repeat the process, with the obvious result that the hypo on and in the film is reduced to one-tenth grain, nine tenths of a grain being removed. A third operation reduces the hypo in the negative to one-hundredth grain, a fourth to one-thousandth grain, and a fifth to one-ten-thousandth grain, representing a final reduction of the hypo originally present to one-hundredth-thousandth.

The question arises:—Is the hypo removed from the emulsion film by simple treatment with water with the degree of completeness indicated by these figures? The chemical measurements of Messrs. Elsden and Warwick have shown that the process falls very

little short of this theoretical perfection in the case of a single plate or film being kept rocked for a period of five minutes after each application of water. Their figures have served to establish the difference which exists between theory and practice, and to provide the necessary compensation for it. No particularly useful purpose would be served by laying down a series of schedules for washing such-and-such a number of plates or film negatives strictly in accordance with these rules; there is no doubt whatever that not one amateur photographer out of a thousand would wish to follow them. But, nevertheless, the measurements which have been made by these two workers provide very valuable guidance in the removal of hypo by washing. Probably many people even now still imagine that hypo is quickly "forced" out of the film of a negative by the application of a stiff spray of water. It is overlooked that the element of time enters largely into the transference of the hypo from the film to clear water which is brought in contact with it. In other words, any method of washing negatives in a continuous stream of water is wasteful of water (unless a number of negatives are arranged to receive the water successively), and does not mean a rapid removal of the hypo. If negatives are washed in this way, the best system, and quite a good one in practice, is to arrange them upon an inclined board or shallow trough, from the highest point of which a small and slow stream of water passes over them. The great virtue of this system is that the negatives are constantly receiving a supply of water uncontaminated with hypo. At the first start of the washing this is the case only with the negative placed at the highest point of the tray, but as washing proceeds and as negatives Nos. 1, 2, 3, etc., successively are washed hypo free, the whole lot, at the end of the process, are assured of treatment with clean water.

But when washing is done, as it very commonly is, in tanks which are unprovided with any means for completely drawing off the water at intervals, the conditions are not nearly so favourable to a quick and complete removal of hypo. On this system a relatively enormous quantity of water must be used in order to obtain the same degree of washing action. The fault of the system is that it does not provide the successive repetition of the two operations which are necessary for the most efficient removal of hypo, viz., (1) soaking of the plates or films for a period, which need not be more than five minutes, and (2) complete withdrawal of the soak-water followed by the application of fresh, and so on for, say, five or six times. Such a system as this which, it will be seen, is on the lines of the theoretical example instanced in an earlier paragraph is more or less perfectly realised by washing tanks fitted with a rapid-action syphon or other means of quickly discharging the contents of the washer when the tank has filled. The worst of most of these pieces of apparatus is that discharge of the water takes place too quickly after the negatives have become covered—there is not the period (of five minutes or so) for soaking, which theory, as confirmed by Messrs. Elsden's and Warwick's measurements, has shown to be an essential part of the process. Thus a practical corollary, in choosing a washer, is to get one several sizes

larger than that for the plates which generally will be handled in it, and so to obtain the extra time (after the negatives have been covered) which is necessary in order to fill the tank up to the point at which the syphon comes into operation.

In the case of films it must be remembered that the chief obstacle to complete washing, as it is also to complete fixing, is the sticking of the films together whilst in the wash-water. If the process is to approximate to the degree of speed and completeness suggested in the previous example, it is necessary that each film be freely exposed to the water in which it is soaking. And it also must be borne in mind that films, in consequence of the gelatine coating on the back, hold something like twice as much hypo as do plates.

From what has just been said the reader will perceive the good grounds there are for urging that there is no better eliminator of hypo from a negative than water. For years past in this Almanac and in the "British Journal" the policy has been followed of dissuading photographers from using the numerous so-called "killers" or destroyers of hypo on the ground that the compounds into which they convert the hypo are not definitely known, and may not be as harmless as is often taken for granted. Seeing that hypo is so readily washed out of emulsion films, there is little reason for using them. In fact, the only occasion when a hypo-destroyer may be said to be of real practical use is when a negative is required for use within a few minutes of having been fixed, and particularly when, as in much photo-engraving work, it also requires to be intensified. In such circumstances it is worth while to make use of a chemical means of destroying, not the whole of the hypo contained in the film, but the small residue which is left in it after a brief washing. For look back again at the example which has been quoted several times, and you will see that under conditions which correspond with those of actual practice, a five-minutes' soak of a negative in clean water removes nine-tenths, i.e., 90 per cent., of the hypo from the film. Probably the use of a spray of water, by reason of the fact that it keeps the surface of the film constantly in contact with water uncontaminated with hypo, reduces this time to two or three minutes. The bulk of the hypo having thus been quickly removed, it is very properly the business of a chemical destroyer to get rid of the rest. For this purpose there is nothing better and, in ordinary times, cheaper than potassium permanganate, which is better than many other so-called hypo-killers, for the reason that it is itself an automatic indicator of the completion of its own action. To make and use the permanganate eliminator, the best plan is to keep a strong stock solution of it, and, at the time of use, to mix the working bath (plenty of it, say, 20 or 30 ounces) by adding a drop or two of the stock solution to this quantity of ordinary tap water. Add only enough to make a solution which is water clear, though of pink colour. Then put your negative in a white porcelain dish, and pour over it an ounce or two of the pink mixture. In the ordinary course the colour will

be at once discharged, giving place to a slightly yellowish tint. At once pour off the solution, and apply a fresh lot. This time the discharge of colour will probably take a little longer. Again pour off and apply another lot, and repeat this process until you come to a point at which the pink colour persists for, say, at least a minute, whilst the solution is covering the negative. When you have got to this point you may take it that the permanganate has chemically destroyed the whole residue of hypo in the negative, and, following a rinse under the tap, the latter can be dried off for printing or is ready for any intensification process. The whole operation of treatment with the permanganate should not occupy on the average more than three or four minutes.

STAIN REMOVERS.

In these days of non-staining developers, acid fixing baths, and tank development, we hear much less than was the case ten years ago of the troubles of stain in negatives, and formulæ for stain removers have become much less frequent. The solutions compounded of alum, chrome alum, or thiocarbamide, and embodied in formulæ on a later page may be mentioned as fully meeting the requirements of those who need to clear away the slight stain which is left in a negative, usually from pyro development. But as a general rule, when a stain remover is wanted at all, it is wanted for a very bad case, and then something very much more powerful in its action than these solutions is needed. In such circumstances, one method is that which was very largely in use in the old days not only for removing stain, but also for reducing excessive density. This is the hypochl[illegible] mula made up by stirring together about one ounce of bleac[illegible] wder (from the drysalter's) with about 1½ ounces of washi[illegible] [illegible] 6 ounces of water. The plentiful solid deposit is [illegible] settle as much as it will, and the supernatant liquid, [illegible] not be perfectly clear, poured off. Mixed with an equ[illegible] of water, this latter forms a very active remover of even deep stain. Unfortunately, it is not without a considerable tendency to reduce the density of the negative also, and, further, has some [illegible] action on the gelatine. Still, used with care, it is a valuable agent, and can be converted into a still more active remover of stain by adding in small doses a saturated solution of oxalic acid, until the mixture ceases to effervesce and becomes slightly acid. This condition is best tested for by using a strip of litmus paper, the paper, which is blue in the original mixture, turns to red when a sufficient quantity of the oxalic solution has been added. In this acid form the mixture is much more energetic in its action on stain, and equally upon the density of the negative. It requires to be used with proportionately more care than the plain mixture of bleaching powder and carbonate.

But of late years photographic experimenters have evolved a much more satisfactory method of dealing with bad cases of stain, which consists in bleaching the silver image of the negative, and thus converting it into a compound, which is unaffected by a very powerful stain remover. Re-development then restores the nega-

tive to its original condition. This process has been given a very convenient form by the Ilford Company in the shape of a solution which at one and the same time bleaches the negative and acts upon the stain. This solution is:—

Potassium permanganate	50 grs.	5 7 gms.
Common salt	¼ oz.	12.5 gms
Acetic acid glacial)	1 oz.	50 gms.
Water	20 ozs	1,000 c c s

If the negative is one freshly made, it is as well to pass it through a weak bath of chrome alum (about 50 grains in 10 ounces of water —i.e., 10 gms. per litre) before applying the bleacher. The latter is allowed to act for ten minutes, rocking all the time. It cannot harm the gradations of the negative, and this full time makes sure of the removal of the stain, and avoids a repetition of the process. After a brief rinse, the negative is left in a solution of potass metabisulphite (1 ounce in 20 ounces of water) until white everywhere to the back of the film, and is then re developed in any non-staining developer.

Drying Negatives.

One point in negative making to which more attention might well be paid—certainly by those who handle negatives in quantity—is the drying. Most of us now realise that negatives dry very slowly in the air of a dark-room, which, from the quantity of water lying exposed in sinks, etc., is very highly charged with moisture. If negatives are simply left there crowded close together in a rack, drying may be a matter of days. For quick drying two things are chiefly necessary—(1) removal of surface water from the negatives as completely as possible, and (2) free exposure in a slightly warm and well-ventilated place. Mr. Warwick's experiments on washing, to which reference has already been made, have a bearing also on drying, for they show the large proportion of water which is mechanically retained by a gelatine film. Much of this can be removed by application of an absorbent material, such as fluffless cotton or linen (an old cambric handkerchief), or, better still, of a piece of chamois leather. The latter will not leave any bits of fibre or fluff sticking to the gelatine. Either fabric or leather is most conveniently applied to a negative of moderate size by laying it down and running a roller squeegee over it.

Where large numbers of negatives are being handled it is, perhaps, not possible to carry out this mechanical removal of part of the water, but no extra labour is involved in avoiding separate drops of water clinging to the gelatine surface. They will not so cling if, in removing each plate from the washing tank, one corner is kept in the lowest position and retained there until the negative has been placed to dry, the drying rack consisting of a board to which a number of pairs of nails have been driven at points, so that each pair supports a negative in the diagonal position. Working in this way, the water drains away in a thin, even film, and does not leave large drops, which create places which take much longer to dry.

As regards the second condition, ventilation is a more potent factor in the expeditious drying of negatives than warmth. The air in a warm place may still be damp, and therefore will be slow in taking up moisture from negatives. But, except in excessively wet weather, the air in a room which is well ventilated is pretty certain to be drier than one which is kept closed.

The best conditions for quick drying are, of course, those in which both these factors are closely combined and, owing to the scarcity during the past year or so of methylated spirit, photographers who have occasion to dry negatives within the minimum of time have necessarily been forced to adopt a system of this kind. Very likely the necessity to do so will have some effect in spreading a more rational system of drying negatives in quantity by the aid of artificial heat and ventilation, and at the same time with exclusion of dust. Such a rapid system would thus seem to consist, first, in passing negatives through a pair of rollers, such as those of the domestic wringer, but covered with chamois leather or other fluffless absorbent covering. After this removal of water from the glass side and much of that from the film they would go to racks (with grooves at least half an inch and better an inch apart), placed in a skeleton frame covered with muslin, and these frames again disposed in a tall cabinet, to which access is afforded from top to bottom by a close-fitting door. When the door is shut air enters only at the bottom, and is there warmed by passing over one or two sheet iron plates moderately heated by low ring gas-burners, then passing upwards and escaping above by a shaft in which there may be an electric fan or a Bunsen gas burner to accentuate ventilation. A system of this kind may be readily devised by the amateur for his negatives to the number of a dozen or two, or by the professional worker for quantities running into hundreds.

OBITUARY OF THE YEAR.

Among those whose deaths have taken place since the publication of the 1917 ALMANAC are:

Dr. Hill Norris (Nov. 15, 1916) | C. F. Inston (May 4, 1917)
Dr. J. H. Smith (Mar. 20, 1917) | C. H. Talbot (Dec. 26, 1916)
W. J. Wilson (Nov. 17, 1916)

DR. HILL NORRIS.

At the time of his death Dr. Richard Hill Norris was probably the oldest experimenter connected with photography. As long ago as 1855 he was the inventor of a collodion dry plate by the bath process. These plates were, in fact, the first dry plates to be commercially sold, and actively came extensively into use about the year 1860. Nevertheless, the Norris dry plate did not survive competition with the wet collodion process. Some thirty years later it was revived by Dr. Norris, and was issued of a much greater degree of rapidity. But at this time, about the year 1883, the gelatine dry plate had obtained a firm hold upon photographic practice, and the Norris plates again continued upon the market for only a short time.

DR. J. H. SMITH.

For many years Dr. J. H. Smith was one of the most familiar figures in photographic circles, not only as a manufacturer of photographic materials but as an experimenter in many branches of photography. For many years a maker of plates and papers at Zurich, in 1908 he installed a small factory at Paris for the manufacture of the bleach-out "Utocolor" papers, which for some years previously had been the subject of much experiment on his part. At the time of his death Dr. Smith had been for a considerable time resident in Manchester, and had been engaged upon chemical research work in the Manchester Municipal School of Technology.

Dr. Smith's inventive faculty was shown in many directions. In the early days of photography he was the designer of machines for the washing and coating of gelatine plates, which were largely used. One of his ideas was a triple-coated plate for the simultaneous making of the three colour-sensation negatives in colour photography. He was early in the field in recognising the advantage of

a geometrical structure in a screen plate for colour photography, and to the best of our knowledge the term "screen-plate" for the mosaic filter used in processes like the Autochrome was first used by him.

C. F. INSTON.

Mr. C. F. Inston was a leading figure in the photographic life not only of the North of England, but of the whole country. First as secretary (in 1905) and afterwards as president (in 1912 and 1913) of the Liverpool Amateur Photographic Association, during which period the inception of the Northern photographic exhibition came into being, Mr Inston may be said to have stood for photography among the societies of the north. He was, in fact, much more than that. Elected a member of the Royal Photographic Society in 1896 and a Fellow in 1901, he served on the selecting committee for the R P.S. exhibitions from 1908 to 1912, and from the latter year until the time of his death was a member of the council of the R.P.S. The Northern Exhibition, first held in Liverpool in 1904, owed its success very largely to his initiative and great powers of organisation.

C. H. TALBOT.

Mr. Charles Henry Talbot was the only son of William Henry Fox Talbot, whose pioneer work in the invention of photography forms a large part of the early history of photographic processes.

Mr. Talbot took a keen literary interest in the work of his father, and was always ready to place his collection of papers and photographs at the disposal of those dealing with his father's work from the historical standpoint.

W. J. WILSON.

Mr. W. J. Wilson was for many years past actively connected with the Paget Prize Plate Company. He was a native of Dublin, where he was born in 1842. In the days when experiments were being made with gelatino emulsion he was the recipient of the prize of £50 offered by Sir Joseph Paget for the best photographic emulsion. As the outcome of that award, Mr. Wilson started the Paget Company in the year 1881, in conjunction with Mr. T. C. Whitfield.

Among others who have been removed by death during the past twelve months are:—John H. Avery, at the time of his death Bombay manager of Messrs. Wellington and Ward; George Bankart, a veteran amateur photographer of Leicester; R. E. Wilkinson, of the Norwich photo-engraving firm; and three notable professional photographers in the persons of W. H. Midwinter, of Bristol; George Hadley, of Lincoln; and W. L. Shrubsole, of Norwich.

EPITOME OF PROGRESS.

BY THE EDITOR.

In the following pages will be found classified abstracts of papers. communications, and articles describing progress in technical photography (art topics are excluded) which have appeared in the British and foreign Press during the twelve months October 20, 1916, to October 20, 1917. Owing to the enforced restriction in paper supply the present Epitome has had to be somewhat curtailed. Items thus omitted will, it is hoped, find a place in succeeding issues of the ALMANAC.

The general arrangement of the Epitome will be seen from the contents of the ALMANAC which follows the title-page. Each item is separately entered in the index at the end of the volume, and a list of the journals abstracted will be found at the conclusion of the Epitome.

In a number of cases where information additional to that in the abstract has appeared in the "British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

Events of Year 1917.

1917 was the period including the thirty first to the forty-third months of the war between Germany, Austria-Hungary, Turkey and Bulgaria (Central Powers), and the Allied nations, including Great Britain, France, United States, Russia, Belgium, Serbia, Portugal, Japan, Italy and Roumania, which began August 1, 1914.

June.—The trustees of the National Portrait Gallery have begun, it was announced, the formation of a collection of portrait photographs of people of prominence in civilian, naval, and military life during the period of the war. ("B.J.," June 22, 1917, p. 321.)

September 15 to October 13—Eighth Exhibition of the London Salon of Photography. Held at 5a, Pall Mall East, S.W.1. ("B.J.," September 21, 1917, p. 483.)

October 8 to November 24.—Sixty-second exhibition of the Royal Photographic Society. Held at the Society's house, 35, Russell

Square, London, W.C. ("B.J.," October 12, 1917, p. 519):—Selecting and Hanging Committees.—Pictorial Section: A. L. Coburn, John H. Gear, J. Dudley Johnston and W. L. F. Wastell. Colour Transparencies; F. T. Hollyer, and W. L. F. Wastell. Scientific and Technical. G. Ardaseer, Charles R. Davidson, F. Low, Dr. G. H. Rodman, Hugh Main and Captain Owen Wheeler.

Snowden Ward Memorial.—The fund, established in 1914 as a memorial to H. Snowden Ward, and applied for the benefit of in or out patients (photographers) of the London Hospital, has so far had no calls made upon it. The following is an abstract of the report dated December 8, 1916:—Capital fund, £180; Central London Railway Prefs., value £153; dividends, including incometax refunded, £23 1s. 7d.; donations and subscriptions, £17 17s.: total, £45 18s. 7d. ("B.J." December 15, 1916, p. 679.)

Business.

Registration of Business Names.—By the Registration of Business Names Act, which came into force February 22, 1917, firms or individuals are required to register particulars of themselves with the Registrar of Business Names, 39, Russell Square, London, W.C., and to observe certain formalities in regard to their business, stationery, catalogues, etc.

An individual is required to register if the title under which he trades does not consist of his true surname, with no addition other than his true Christian name or initials.

The same thing holds good in the case of a firm. If the title of the firm does not consist of the true surnames of all the partners, with no additions other than their true Christian names or initials, then the firm requires to be registered.

Also, if an individual has at any time changed his name, then his business name requires to be registered. He may be carrying on business under his present name, but if that is not his original name, then the Act applies to him.

Again, this condition applies also to firms consisting of two or more partners. If any member of a firm has at any time changed his name, then the firm with which he is connected comes within the scope of the Act.

But this condition (past change of name) does not apply to a woman who has changed her name by marriage, nor does it apply to natural born British subjects who have changed their Christian or surnames before reaching the age of eighteen years.

The Act applies both to aliens and those of British nationality.

Firms trading as "Bros." are required to register, even though the firm may consist actually of two brothers in partnership. A slight change of name undoubtedly makes it incumbent upon a firm or individual to register.

As regards the formalities to be observed by those firms who are called upon to register, Section 18 of the Act enforces upon the principals of registered firms the statement of their true Christian name (or initials) and surname upon trade catalogues, trade circulars,

showcards, and business letters. If of British nationality, that is all the addition which requires to be made to business stationery, but if an individual, or member of a firm, is not of British nationality, then he must also state what his nationality is. And, further, if his present nationality is not his original nationality, that is to say, if it has been acquired by taking out naturalisation papers, then he requires to state what his original nationality was. In other words, a Spanish subject in Great Britain must say that his nationality is Spanish, even though he has become a British subject by naturalisation. This again applies to individuals and also to every member of a firm. ("B.J.," March 16, 1917, p. 132.)

In regard to the question whether individual photographers or photographic firms who are called upon to register are also required to place particulars as to their real name, change of name, and nationality on mounts and postcards sold in the ordinary course, a leading article in the "British Journal" expresses the opinion that they are not so required. Section 18 of the Act makes it clear that these particulars are to appear on a firm's trade stationery, among which it mentions "showcards." The Act's definition of a showcard may certainly be held to [illegible] a mounted photograph, but there is nothing in the Act to suggest that the goods supplied by an individual or firm require to be marked, and photographs such as a photographer supplies to his customers certainly come within this category.—"B.J.," March 23, 1917, p. 146.

A further Act, the Companies (Particulars as to Directors) Act, of 1917, brings directors of limited liability companies within the provision of the Registration of Business Names Act. Moreover, in the case of companies registered since November 22, 1916, the business stationery of the firm requires to bear particulars of change of name or of nationality of directors, as is required of proprietors of, or partners in, a private firm which comes within the scope of the earlier Act.—"B.J.," August 17, 1917, p. [illegible]

Commercial Photographer.—At a meeting held on April 17, 1917, the proposal of forming an association of commercial and technical photographers was discussed. The meeting was adjourned for the purpose of considering an alternative scheme, subsequently adopted, of forming a commercial section of the Professional Photographers' Association.—"B.J.," April 20, p. 206, and April 27, p. 224, 1917.

Fourth Rise in Plate and Paper Prices.—On March 1, 1917, the fourth rise in the price of dry plates subsequent to but including that of June 16, 1915, was made by British manufacturers. In the case of plates, the increase applies to the list prices: in the case of papers, the list prices remain the same, but discounts have been reduced to a figure which represents an increase in price of approximately 20 per cent. The present prices per dozen of dry plates are now:—2s. 3d. in the quarter-plate size, 5s. in half-plate, and 9s. 6d. in whole-plate. This further advance in price is uniformly ascribed to continual rises in manufacturing cost and in prices of raw

materials. It represents the fourth increase been made in the price of dry pl ce these latter were on the market (that is, before June, 1913) at the "popular" price of one shilling per dozen quarter-plates. The successive increases in price which have been made are shown in the following table:—

	s.	d.
Before June 16, 1913	1	0
June 16, 1913	1	3
March 13, 1915	1	6
February 29, 1916	1	10
March 1, 1917	2	3

Basing a calculation on the above prices, the latest advance represents a rise of 22½ per cent. over the rate previously in force. In comparison with the "popular" shilling price, the amount 2s. 3d. represents a rise of 125 per cent., while the increase in price which has been made during the period of the war, namely, from 1s. 3d. (at which it stood in August, 1914) to the present date is 80 per cent.—"B.J.," March 9, 1917, p. 126.

Minimum Prices for Developing and Printing.—The Photographic Dealers' Association (Great Britain), in October, 1916, drew up the f of c es for the developing and print film exposure

	Developing per doz. s. d.		Printing per doz s. d.
No. 1 Brownie, V.P.K., etc.	. 1 0	...	1 3
No. 2 Brownie 3¼ by 2¼	.. 1 0	...	1 6
Nos. 1a and 3 F.P.K. or ¼ pl	.. 1 6	...	2 0
No. 3a F.P.K. or P.C. and by 4....	.. 2 0	...	2 6

(Spools of 6 and 8 exposures to be charged pro rata.)

These prices were agreed to as the lowest which should be charged by photographic de throughout the British Isles.

Rights to Photograph.—The c e relating to the conditions under which the rights to photograph in an exhibition may be acquired ("B.J.A.," 1917, p. 302) has since been carried to the Court of Appeal by which the judgment of Mr. Justice Horridge was upheld, namely, that, in order to make such right a legal one it was necessary for the promoters of the exhibition to grant admittance to the public only under a promise that photographs should not be taken.—"B.J.," February 16, 1917, p. 88.

Rotary Photographic Company.—The factory and plant of this enemy firm were offered for sale by auction, in one lot, on July 5, 1917, but were not then sold.—"B.J.," June 22, 1917, p. 333.

Eastman Kodak Company.—According to the report of the Eastman Kodak Company for the year ending December 31, 1916, the net profits, including those of the various associated companies, was $3,564,784, the largest in the history of the company.—"B.J.," June 8, 1917, p. 302.

Developer Trade Names.—The following are the registered trade names of some developers of enemy origin. Although in every case the patent rights in the manufacture of the developing substance has expired, the monopoly in the substances is practically continued by the registration of the trade mark.

Registered Trade Mark.					Patent.			
..	Number.	When Registered.	By Whom.	Renewed.	Number.	Year.	Patentee.	Expired.
Adurol........	213,062	1898	Actien Ges	1912	13195	1898	Hauff .. .	1912
Edinol.... ..	242,464	1902	Bayer ..	--	12421	1901	Bayer.....	1914
Eikonogen.. ..	92,059	1899	Actien Ges .	1903	5207 25002	1889 1889	Andresen..	1903
Imogen	212,669	1898	Actien Ges .	1912	21555	1898	Action Ges	1902
Rodinal	159,372	1891	Actien Ges ..	1905	1736	1891	Actien Ges	1905
Unal........ .	253,559	1903	Actien Ges . .	—	11866	1901	Actien Ges	1907

—"B.J." (from "Chemist and Druggist"), Feb 2, 1917, p. 62

Copyright.

Copyright and Contract.—Some interesting notes on the law of contract and copyright in reference to the making of portrait photographs have appeared in the "Solicitors' Journal."

In regard to the free-sitting business, the "Solicitors' Journal" "apprehends" that assignment of copyright to the photographer need not, under the present Act, be in writing; and, in the case of litigation, evidence as to the transference of copyright may be collected from the evidence. It needs to be pointed out that this is an opinion, based on the difference of wording between the two Acts, and, therefore, should not be taken as definitely supporting departure of the customary plan of obtaining the assignment in writing.

In regard to the inconvenient case of Stackemann v. Paton, the "Solicitors' Journal" considers it obsolete, as a consequence of the somewhat different conditions of ownership of copyright applied by the 1911 Act.—"B.J.," June 15, 1917, p. 313.

Photographer and Sitter.—An old case, that of M'Cosh v. Crowe and Co., in the Scottish Court of Sessions, 1903, has not been previously fully reported in photographic journals. The ruling of the Scottish Appeal Court upheld the view that a photographer stands in a confidential relation to his customer who orders portraits in the ordinary way. The special interest of the judgment in M'Cosh v. Crowe is that the implied contract between a photographer and a customer extends also to a second photographer who acquires the business of the first.—"B.J.," June 15, 1917, pp. 311, 313.

History.

The Boulton-Watt Legend.—The death of Mr. C. H. Talbot, son of Fox Talbot, on December 26, 1916, having revived the tradition that permanent photographs were produced towards the end of the 18th century by James Watt and his partner, Matthew Boulton, a detailed account of the facts relating to this legend, which was investigated in the years 1863-4, has been published in the "British Journal." The specimens which about this period were alleged to have been produced long before the publication of the processes of Daguerre and Fox Talbot were of three kinds—(1) Camera images of natural objects on silver plates, (2) large copies of paintings; and (3) paper prints. The matter became public on an official of the Patent Museum, then at South Kensington, visiting Boulton's factory towards the end of 1852. He there came into possession of the different descriptions of specimen. On investigation, chiefly by members of the then London Photographic Society (now the Royal Photographic Society), it was found that the camera pictures on silver plates were most probably poor attempts at Daguerreotypes made by a Miss Wilkinson, about the year 1839.

The copies of paintings were undoubtedly of very much earlier date, evidence pointing to their existence in 1790, and probably ten years earlier. They were, however, judged to be for various reasons non-photographic in origin. In every case where the reproduction could be compared with the original it was found that the two were the same size, but that the copy was reversed as regards right and left. Some were in monochrome, others in colour. Apparently, from the documentary evidence, an employee of Boulton's, named Francis Eginton, made "transfers" which were afterwards worked up in monochrome or colours by artists. A considerable trade was done by Boulton in these "mechanical paintings" towards the end of the 18th century. Apparently the process was something akin to that employed for the so-called "polygraphs" associated with the name of an artist named Joseph Booth, which were brought before the public by way of an exhibition about the year 1790.

The photographic prints alleged to have been made by James Watt were brought to the notice of the public by Miss Meteyard, an irresponsible writer on the Wedgwood family (associated with Watt, Boulton, and other Birmingham notabilities in the Lunar Society). One of them, a breakfast table scene, was shown to have been made by Fox Talbot; the other, of which the subject was a Savoyard piper, was non-photographic in origin.

A further legend was put in circulation by Miss Meteyard equally without any supporting evidence, namely, that Daguerre obtained information for his invention from the Wedgwoods. The latter employed a Paris agent, named Dominique Daguerre, who it was suggested was the father of the inventor of Daguerreotype, the latter witnessing Tom Wedgwood's experiments on photography when visiting the potteries in company with his father. It can be shown, however, that at the time of such visits Daguerre must have been a child of four or six years of age.—"B.J.," Jan. 12, p. 18, and Jan. 19, p. 33, 1917.

II.—APPARATUS AND EQUIPMENT.

(Including Also Materials Used in Photography.)

Dark Room and Studio.

Colouring Electric Light Bulbs.—Make a solution by mixing the white of one egg, previously beaten to a froth, with one pint of distilled water. Filter, and skim the surface free from bubbles. The globes to be coloured are thoroughly cleaned and polished, then dipped in the liquid, and hung up to dry. When dry, the dipping is repeated, and they are dried again thoroughly. The colouring solution is made by dissolving 10 to 50 grs. of any soluble aniline dye in 4 fl. oz. of collodion. In this the prepared globes are dipped and hung up to dry. The dipping is repeated if a darker tint is required.—"B.J." (from "Pharm. Journ."), June 15, 1917, p. 317.

Design for a Dish Rock.—D. Charles has suggested a design (Fig. 2) for a dish rocker which obviates the defects of excessive movement of the contents of a dish, uncovering of the plate, and consequent slow period of running inherent in the customary pattern of pendulum rocker (Fig. 1). The rocker designed to avoid these defects is shown in Fig. 2. C is the developing bench under which is hung the pendulum, and should be fairly level.

On the pendulum stem near the top is fixed an arm, E, at right angles, and turned up at the ends. Holes are bored in the bench to allow these ends to swing up through. The dish, D, on being placed over this device, will be level and still most of the time, but will receive a lift at each end as the weight swings to and fro, thus keeping the developer in motion evenly over the plate without unduly tilting.

At the same time, the pendulum will be found to swing for a longer time with one start, for, not only does it have no braking

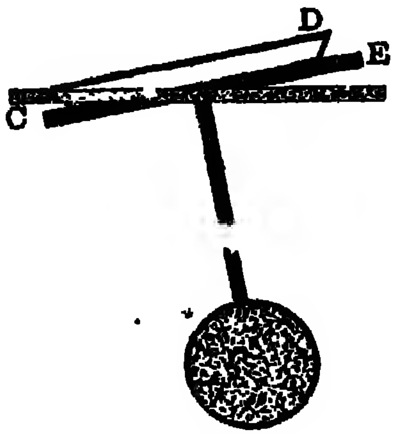


Fig. 1

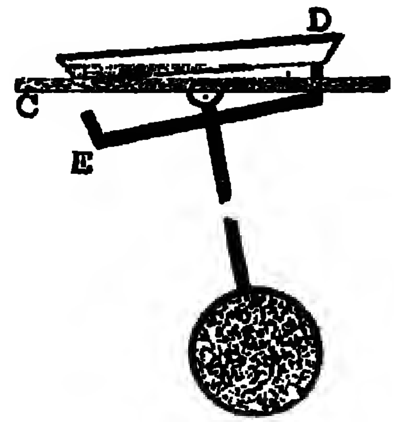


Fig. 2.

action, as in the usual pattern, but the weight of the dish (in the case of a large porcelain one) will give it a little extra impetus instead.—"B.J.," June 8, 1917, p. 302.

Lenses and Photographic Optics.

Fine Focussing by the Parallax Method.—The principle of this method of fine focussing is explained by the diagrams. In Fig. 1 a lens is shown bringing a point to a sharply defined image at F, a little in advance of the focussing screen, S. In Fig. 2 this image is shown as being produced on the side of the focussing screen towards the observer, i.e., further from the lens. In Fig. 3 it is shown as produced on the focussing screen itself, that is, Fig. 3 shows the condition of the sharpest possible focus. It will be seen from these drawings that if there is a minute mark, e.g., C, on the clear focussing screen, the movement of the eye from, say, A to B, will cause an apparent movement of the point of the image which is being focussed in the cases of Figs. 1 and 2, whereas in the case of sharp focus the image of the point will remain fixed in reference to the mark on the screen when the eye is moved. In practice the essential operations in this method of focussing thus are:—

(1) Bring the subject roughly into focus on the ground part of the screen. (2) Select some small and convenient piece of detail that is visible on the clear part of the screen, and that falls near one or more of the lines marked on the glass. (3) Note whether this selected part of the visible image appears to move or to remain stationary, relative to the marks on the screen, when the eye is moved through a short lateral distance. (4) Remember that if the image moves with the eye the screen is behind the focus, and needs

racking forward. If the image moves in the reverse direction to the eye the screen is in front of the focus (*i.e.*, too near the lens), and

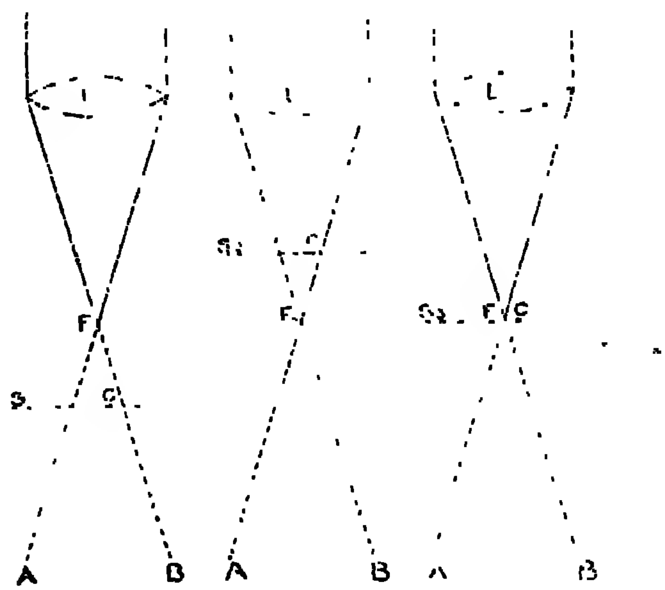


Fig. 1 Fig. 2. Fig. 3

needs racking backwards If there is no visible movement of the image, the focus is as exact as possible.—"B J" June 22, 1917, p. 322.

Shortening and Lengthening Focal Length —For this purpose the most useful lenses, within their limits, are the single spectacle glasses which are stocked by spectacle makers in powers measured, not in focal lengths, but in diopters. A power of 1 diopter is a focal length of 1 metre or 39 37 inches One of 2 diopters is half a metre (19 2 3rds inches), and so on. Lenses are usually stocked in powers differing by ¼ of a diopter The following table includes a series from ½ to 3½ diopters, which cover all that are likely to be required for use as supplementary lenses. The focal lengths in inches are approximate only.

·5 D	=	78¾	.. ..	2·0 D	=	19[illegible]
·75 D	=	52½	....	2 25 D		17½
1·0 D	=	39·4	....	2 5 D	=	15¾
1 25 D	=	31½	....	2 75 D	=	14¼
1·5 D	=	26¼	....	3·0 D	=	13⅛
1·75 D	=	22½	....	3·5 D	=	11¼

To find the supplementary lens required to alter focal length, first find the separation, or its nearest equivalent, which may be taken as about half the length of the doublet, if that is of the symmetrical type Deduct this dimension from the focal length of the doublet, and multiply the result by the focal length required. Then divide the result by the amount by which the focal length

is to be shortened or increased. For example, suppose we want to reduce an 8-in. lens to a 6 in. one—that is, reduce the focal length by 2 ins. We may take half the length of the doublet as being 1 in., and deducting this from 8, and multiplying by 6 we get 42. Dividing this by 2, we find that a lens of 21 ins. is required. This must be a positive lens. The nearest to this is a lens of +2D power, or 19 2 3rds ins. To increase the focal length from 8 to 10 ins., or by 2 ins., we should proceed similarly. Multiply 8—1 by 10 and divide by 2, the result being 35, which is nearest to 31½ on our table, that is to a lens of -1 25D. A negative lens is always required to increase focal length and a positive one to diminish it.

In a general way lenses of lower power than 1 diopter are not of service, whilst those below 2½ diopters are not advisable. Variations of less than ½ a diopter make very little difference. Thus the most useful series of powers (negative and positive) are 1, 1½, 2, and 2½ diopters. Their effect on lenses of 3, 4, 5, 6, 7, and 8 inches focal length is very approximately stated in the following table, in which allowance is made for a separation varying from ½ in. to 1 in., according to the focal length of the original lens.

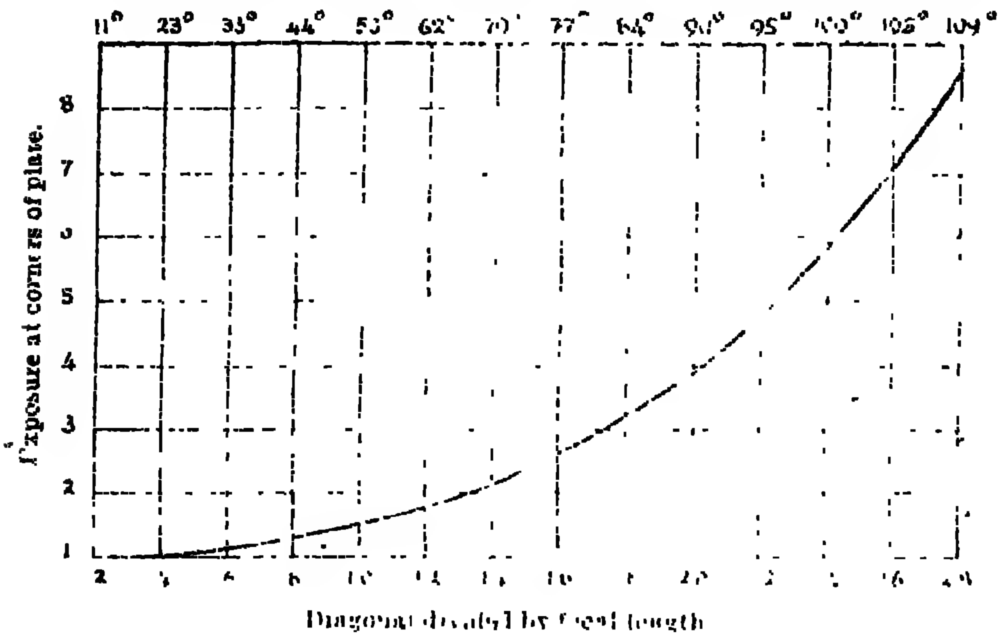
Supplementary Lenses, Powers in Diopters.	Original Focal Lengths in Inches.					
	3	4	5	6	7	8
+2½	2[illegible]	3[illegible]	3[illegible]	4[illegible]	5	5½
+2	—	3[illegible]	4[illegible]	4[illegible]	5[illegible]	6
+1½		3[illegible]	4[illegible]	5	5[illegible]	6[illegible]
+1	2[illegible]	3[illegible]	4½	5[illegible]	6	7
−1	3[illegible]	[illegible]	5[illegible]	7	8[illegible]	9[illegible]
−1½	—	[illegible]	6	7[illegible]	9	11
−2		4	6[illegible]	8[illegible]	10	12½
−2½	3[illegible]	5	6[illegible]	9	11[illegible]	14½

Blanks are left in the 3 in. [illegible] column because the different effects of 1½ and 2D supplementary lenses are negligible. The former may be considered to have the same effect as 1D and the latter the same as that of 2½D. The most useful variations are given with lenses of 5-in. focal length and upwards.—"B. J.," January 26, 1917, p. 44.

Exposure at Margins with Wide-angle Lenses.—Apart from any effect of cut-off by the mount of the lens, the intensity of illumination on the plate towards the margins follows the rule formulated by Dr. Zschokke, namely, that the light entering the emulsion at any point on the plate is proportional to the fourth power of the cosine of the angle of obliquity of the light-pencil—i.e., is proportional to $\cos^4 \theta$, where θ is the angle of obliquity.

The following curve has been worked out according to this formula for the purpose of providing a ready indication of the extent to which illumination falls off up to angles of 100 deg

Thus in the case of an angle of 100 deg., it is seen, by following down the vertical line below "100 deg.," that six times the exposure at the centre of the plate is required. The figures below the diagram simply express the angle of view in another way—namely,



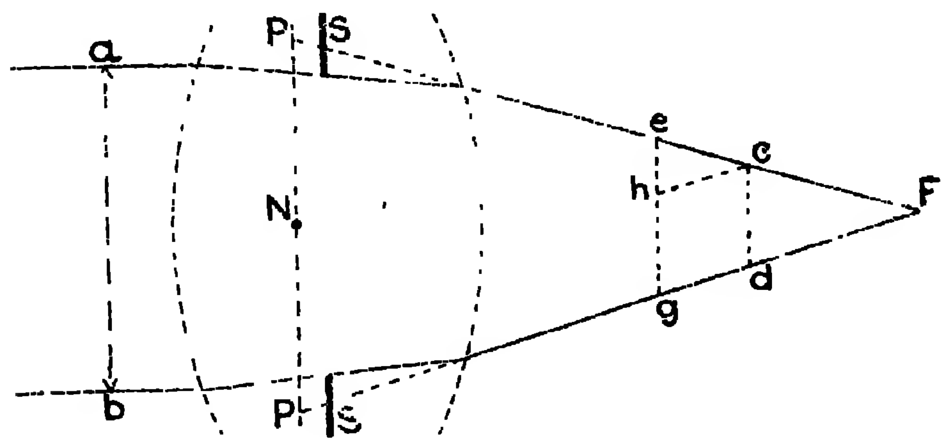
the diagonal of the plate divided by the focal length. It will be seen that for angles up to 53 deg. the illumination at the margins is not much less than at the centre, always providing there is no cut-off by the mount of the lens. An $f/8$ [illegible] will probably give this degree of equality of illumination [illegible], but an R.R. will probably require stopping down to $f/16$. It is only in the case of extremely wide angles that the intensity of illumination at the margins is so much less than at the centre that marked under exposure will result. In the case of moderately wide angles, such as, say, 68, effects of under exposure at the margins are likely to show only when the plate is somewhat under exposed. In other words, correct exposure for the middle will show as under exposure at the margins, whereas correct exposure for the margins is not likely to exhibit any marked effect of over exposure in the middle. —"B.J.," April 20, 1917, p. 203.

Direct Measurement of (Angular) F Number.—C. Welborne Piper, in a paper and demonstration before the Croydon Camera Club, described an instrument designed by him for direct measurement of the (angular) F number of a lens—i.e., without measurement of the focal length. The drawing shows the nature of angular aperture as distinguished from effective aperture. The latter is the diameter of the diaphragm S S, or, rather, the diameter of the cone of parallel rays, which, after undergoing convergence by one element of the lens, just coincides, at the diaphragm, with the aperture in the latter. This effective aperture

divided into the focal length, is the effective F number—i.e., the number which indicates the speed of a lens.

The angular aperture, upon which depth of focus depends, is, on the other hand, the diameter of the base of the cone of rays which has its apex at the focus F, where this base intersects the principal plane of the lens P P. The focal length divided by this diameter is the angular F number. In some few lenses the effective F number is the same as the angular F number, but in any well-corrected lens of large aperture the angular aperture is somewhat larger than the effective aperture or the F number is smaller. In the case of an original Goerz "Dagor" the effective F number of the largest stop is *f*/7.4; the angular F number 7.15.

As shown in the drawing, the angular F number is the ratio of N F to P P, and the geometrical construction shows that this ratio is the same as that of the distance from F to *c d* divided by *c d*, or the distance from F to *e g* divided by *e g*. Drawing *c h* parallel



to P F, the small triangle *e c h* is similar in all respects to P F P and to *c* F *d*. Thus the distance from *c* to the centre of *e h* divided by *c h* will give the same value as N F divided by P P—that is, the angular F number. Mr. Piper's measuring instrument is thus based upon a simple visual observation of the width of the cone of rays at, say, *e g* and again at *c d*. The second measurement is subtracted from the first and the difference divided by the distance between *e g* and *c d*, which latter can be fixed once and for all in constructing the instrument.—"B.J.," May 25, 1917, p. 272.

Gelatine-Filled Lenses.—M. J. Gurin has taken out a patent (described as an improvement on that of Patent No. 18,919, 1892) for a lens composed of glass mounted in a case or tube and with the space between them filled with transparent material of a plastic or jelly character, such as a mixture of gelatine and glycerine. The glasses of the lens may be of any shape or form, and be polished on one or both surfaces. The specification describes and illustrates two

lenses, a double convex and a plano-convex of this construction. Eng. Pat., No. 101,260.—"B.J.," December 1, 1916, p. 652.

Size of Image. F. W. G. Campbell gives the following memory rule for use as a basis in judging the size which any object will have on the focussing screen when photographed with a lens of given focal length. If you are distant from an object the length of that object, your image has a dimension equal to the focal length of your lens. Example:—If an object is 100 ft. long and you are 100 ft. from it, and the focal length of your lens is 8¼ inches, then the image on the ground glass will be 8¼ inches in length. This rule, which can be derived from the customary formula for conjugate focal lengths, can be of service in certain circumstances.—"Journ. of Phot. Soc., India," June, 1917, p. 191.

Lens Names.—Practically all the coined names which have been applied to photographic lenses are classified according to their derivation by "H.L.," who comes to the conclusion that all the possibilities of ringing the changes on Greek and Latin words indicating the real or supposed property of the lens or its construction (or use), or some property of light have been exhausted. He takes the view that a good lens name should be short, should sound well, and should have some connection with the lens, avoiding as far as possible obvious Greek and Latin derivatives.—"B.J.," June 22, 1917, p. 325.

Silvering Glass.—Raymond Crowther, in a demonstration before the Royal Photographic Society, describes a method of silvering glass in which caustic soda is used instead of caustic potash. This and other chemicals are of ordinary purity and the glass to be silvered can be treated face up. Mr. Crowther uses an ammonia solution of silver nitrate in conjunction with a mixture of two reducing solutions, one of which consists of sugar in admixture with nitric acid.—"Phot. Journ.," June 1917, p. 185; "B.J.," July 20, 1917, p. 375.

Cameras and Accessories.

Slower Speeds with Focal-plane Shutters.—Lieut. B. T. J. Glover has described how he modified the Kershaw focal-plane shutter, as fitted to the reflex camera sold as the "Soho," etc., by other means than reducing the spring tension, this lattter plan having the drawback of not completely closing the aperture in cold weather when the blind is somewhat stiff. The method consists in making the tape roller of the shutter of slightly greater diameter by glueing a split rubber tube round it beneath the tapes. When thus modified the blind will run smoothly at the lowest spring tension without any bulge occurring at the end of the run. Thus modified, the shutter at the lowest working spring tension gave the results set forth in

the following table, whilst before the alteration the slowest speed was 1/16th of a second

Total blind run.	Width of slit.	Efficiency $e = \frac{s}{s+p}$	Approximate time of total blind run.	Efficient exposure. (See footnote.)	Approximation for practical use.
Inch.	Inch.	%	Sec.	Sec.	Sec.
9 5	4 75	90	[illegible]	[illegible]	[illegible]
9 25	4 00	88	[illegible]	[illegible]	[illegible]
8.50	3 00	86	[illegible]	[illegible]	[illegible]
7 50	2 00	80	[illegible]	[illegible]	[illegible]
7·00	1 50	75	½	[illegible]	[illegible]
6·50	1 00	66	[illegible]	[illegible]	[illegible]
6·37	75	60	[illegible]	[illegible]	[illegible]
5 89	·50	50	[illegible]	[illegible]	[illegible]

e = efficiency, s = width of slit, p = width of pencil of light intersected by blind ⅛th inch from the focal plane using a 6 inch lens at f/6.5.

Efficient Exposure $= \frac{\text{width of slit}}{\text{total blind run}} \times$ time of total blind run $\times$ efficiency.

Total blind run = Distance travelled by any point of the blind from the beginning to the end of the blind movement.

This table shows a very useful range of exposure speeds. It must be borne in mind that the figures denoting the higher speeds are *light-value* factors only. These higher figures do not denote the shutter's power of arresting movement, because of the low efficiency. For example, the exposure marked 1/150 sec. light-value will only arrest movement to the degree that a shutter of perfect efficiency would at 1/90 sec. For pictorial and all ordinary work, however, the light-value of a shutter exposure is the knowledge required and a lower efficiency at the higher speeds does not matter.

The shutter, as altered, suffers from the following defects:—

(a) There is some difficulty in holding the camera steady. In the case of the slowest exposure ([illegible] sec.) the camera must be kept still for 3-10ths sec.

(b) The blind slit decreases slightly in the course of its run. This can be reduced to a minimum by so adjusting the tape roller that its diameter is only slightly greater than the blind roller. As the result of the makeshift adjustment the blind slit decreases ⅛ inch in the course of its run. The smaller the blind slit the more this decrease matters. With a 1 inch slit it means that the upper part of the picture (lower part of the plate) gets 12 per cent more exposure than the lower. This defect is increased by the tendency of all blinds to run more slowly at the end of their course, particularly on low tensions. In practice it is not found to affect the results.

Should it be necessary to do high-speed work the best course is to increase the spring-tension to a maximum and use the widest slit the subject will allow, thereby keeping the efficiency of the shutter high.—"B.J.," April 6, 1917, p. 187.

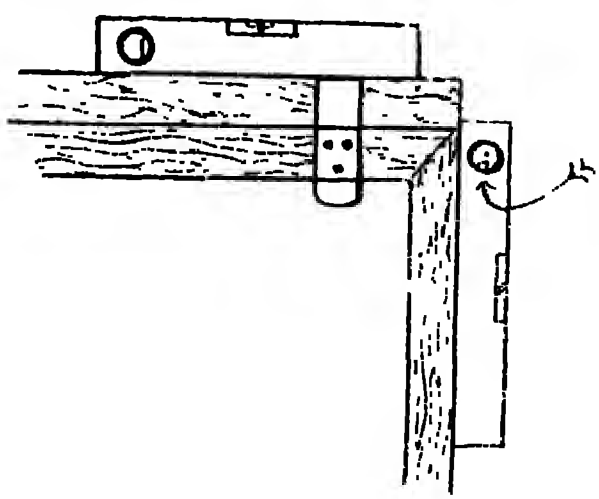
Reflex Telephoto Cameras.—M. Cantoni, A. Vautier-Dufour, H. Wakker, and H. Honegger-Cuchet have patented a type of reflex camera in which the use of a long-focus lens is made possible by means of two mirrors from the surface of each of which in turn the bundle of rays from the lens is reflected. The camera is further designed for use when pointing directly downwards as in aerial photography, the focussing screen and plate occupying a vertical position. Eng. Pat. No. 101,970. "B.J.," July 20, 1917, p. 380.

Use of the Spirit Level.—D. Charles recommends as suitable for use with the stand camera a 6 inch "boat shape" spirit level as supplied by tool-sellers. It should have a hole in or near one end, and a short cross-tube for use against vertical objects.

This cross-level is seldom provided with a point to mark the centre, but it is only a few moments' work to make one. If one puts the level on top of the camera and adjusts the latter so that the bubble is central, and then places the level, without shifting the camera, against the side as in the drawing, it is an easy matter to drive a pin into the wood against the centre of the bubble in the cross-level, as shown by the arrow.

This level slips comfortably into the pocket, and can be used for any number or variety of cameras.

To use it, in practice the camera is set up with the front and back at right angles to the base (or thereabouts), and when the subject is roughly composed on the screen the level is held against the side of the camera, in the same position as when fixing the centre-point



The centre leg of the tripod (i.e., back or front) is then moved slightly towards one side or the other in the same direction as it is required to shift the bubble in the cross-level. This is quicker and much more easy to see than when using an ordinary level on top of the camera. The same thing is done in cases where the camera is pointed up or downwards. Next the level is held in the same upright position against the ground-glass and the back swung until

the bubble is again central. Those two motions ensure perfect upright lines.—"B.J.," November 25, 1916, p. 640.

Flexible Tripod Base.—H. W. Fincham has designed a highly portable support for the tripod by which the latter can be kept firmly placed on a flat polished surface. The support being flexible, it is also specially serviceable under conditions where the tripod requires to be used in places which vary in level (*e.g.*, a stairway). It consists of a metal disc about the size of a five-shilling piece, to the edges of which are attached, with equal spaces between them round the disc, three lengths of somewhat coarse metal chain. The chain used by Mr. Fincham is a fairly common article among ironmongers, by whom it is sold as "ladder chain." Each link is of rectangular shape, measuring about half an inch in breadth and about three-quarters of an inch in length. The form of the link thus allows of the tripod-point finding a secure hold. With the three chains spread out on a level surface the points of the tripod can be inserted at any required distance from the central disc. The camera can thus be set at any required angle, and once so set can be readily moved about without disturbing its angle.—"B.J.," July 27, 1917, p. 385.

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

Portraiture.

Half-Watt Portrait Lamps. H. Essenhigh Corke describes the arrangement of half-watt lamps employed by Hugh Cecil in his studio, Victoria Street, London, S.W. The fittings used are those supplied by the General Electric Company, and yield a strong indirect light from the ceiling, or from a white screen over the lamp, together with direct illumination from a smaller and movable lamp. Mr. Cecil, however, uses two hanging lamps as shown in Fig. 1. These are of 3,000 c.p., and should be hung about 9 or 10 ft. from the floor, with the ceiling or reflecting screen 2 or 3 ft. above the lamps. The movable standard B is generally supplied with a 1,000 c.p. lamp, but may with advantage carry a 2,000 c.p. lamp. Fig. 2 is a ground plan of the studio shown in perspective in Fig. 1.

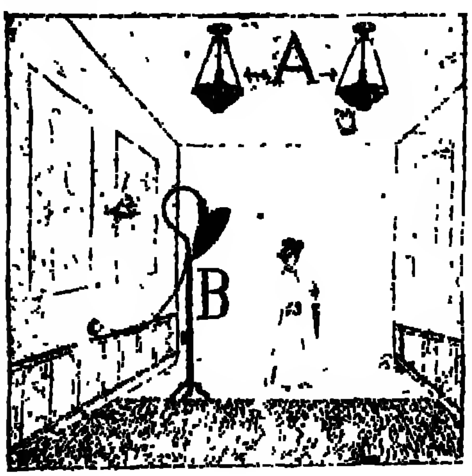


Fig. 1

A. Two lamps (each 3,000 c.p.) at about centre of room, as illustrated p. 19, G.E.C. catalogue. B. Small standard (one 2,000 c.p. lamp) as illustrated p. 17, G.E.C. catalogue.

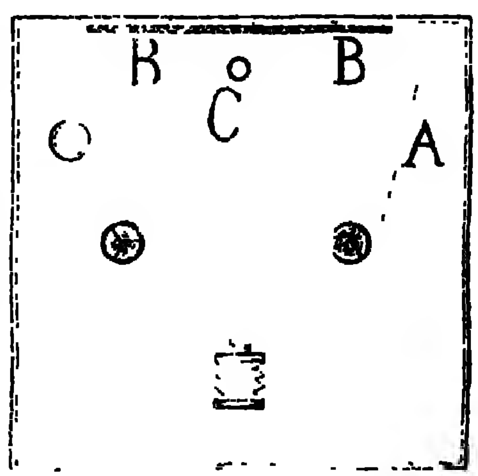


Fig. 2 (ground plan of fig. 1).

A. An ordinary reflector may be used here, but is not actually necessary. B. Background. C. Sitter.

In a small studio excellent work may be done with a much less elaborate arrangement shown in plan in Fig. 3, and consisting of

two 2,000 c.p. lamps placed about 7 ft. from the background upon the side wall, and provided in front with a screen of one thickness of tracing linen. The lamps are backed with a curved reflector of

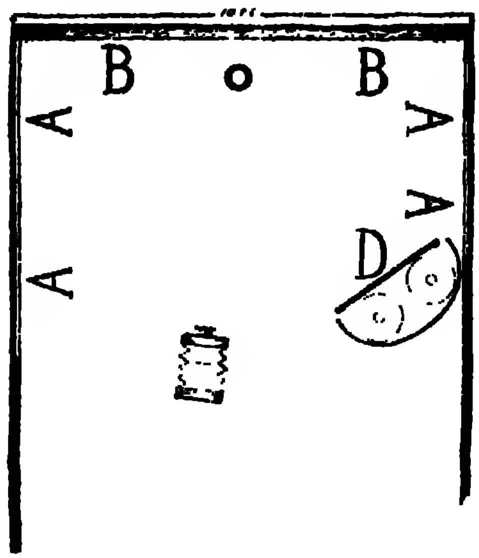


Fig. 3

A. Whitewashed walls. B. Background on wall. D. Wooden frames about 24 in. by 10 in. covered with tracing linen, placed in front of two 2,000 c.p. lamps.

zinc, about 5 ft. by 4 ft., painted white. The wall AA, opposite the lamp is white, and with the sitter placed midway in front of the background (as shown by the circle in the drawing) well lighted and well modelled effects are obtained, the exposures on extra rapid plates with f/6·8 averaging about five seconds.

Another installation, based upon the Marion oval fitting for two half-watt lamps on one of the Northlight stands, is as follows:—

Into an oak wood base 15 ins. square (Fig. 4) is fitted an iron pipe, with another smaller pipe sliding within it. This smaller pipe has a T-piece cross top and is bored with a hole every 6 ins., so as to be able to regulate the height. At a distance each side of the centre of the T-piece is fixed the fitting into which each lamp is screwed, so that, when in position, the lamps are 6 ins. apart from each other—that is to say, there is a distance of 6 ins. between each globe. From the centre of the T-piece another smaller iron bar or rod extends forward at an angle of about 45 deg. and outward for 18 ins., and the end of this rod is spread into a Y-form with the point of each of the tops of the Y turned up about 2 ins.

Then a spring roller blind is made of white holland backed with black holland. The width of the material is 42 inches. This blind is fitted to a piece of wood 2 inches by 1 inch, with two holes bored into it so that it could be slipped on to the two points of the Y. The length of this blind is 8 ft.

At a distance of about 18 inches from the top of the T piece (practically the actual centre of the glass bulbs of the lamps) a thin

rod is made to go through a hole bored in the standard, having at its end another rod 42 inches long. This latter can be regulated to any position by a small screw.

When not actually in use all that appears in the studio is the

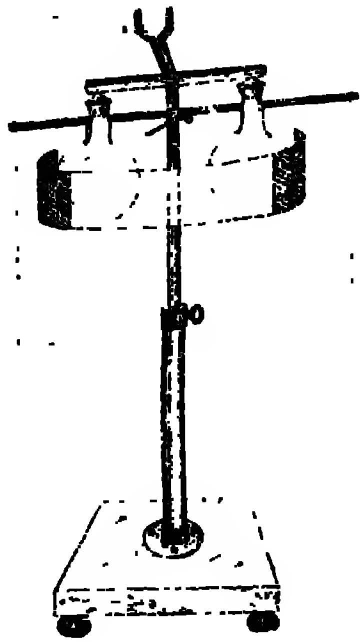


Fig. 4.

iron standard with its two naked lamps, but it is the work of only a moment to place the roller blind upon its two points, draw down the blind, and push out the rod, so as to make the blind hang over, and down, behind the lamps at about the angle shown in Fig. 5.

In order to diffuse the too strong direct light another little wire

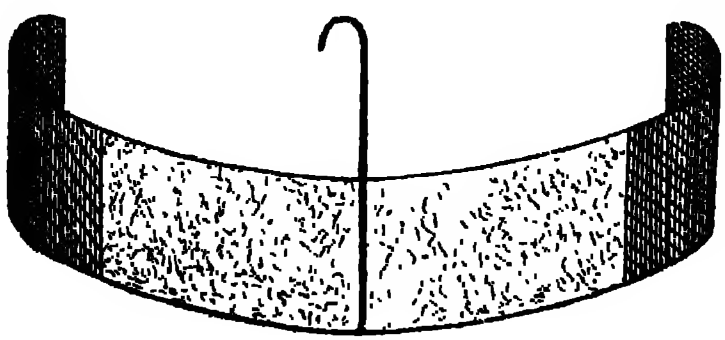


Fig. 5. Fig. 6.

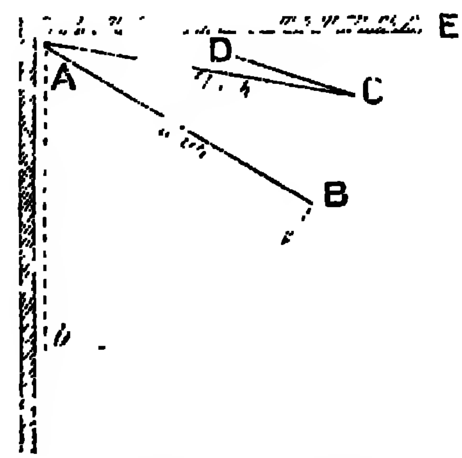
fitting is made This also takes off and on as desired by slipping into a little slot on the standard. Fig. 6 will illustrate this wire fitting, which is covered with one thickness of tracing linen, and for

about ten inches at each end with some opaque material, so as to prevent the strong rays from shining on the background and into the lens. A long flex is fitted to the switches in the centre of one of the studio walls, and this standard can thus be moved about on its castors to any part of the room.

The lamps first fitted were each of 2,000 c.p. and gave very good results with an average exposure of about four seconds, but as in some cases this was felt to be rather too long two 3,000 c.p. were substituted later so that the exposure could be cut down.—"B.J.," March 30, 1917, p. 169.

A. Wise utters a warning against using any half-watt lamp of lower power than 1,500 c.p. for portraiture if exposures of reasonable shortness are required. An opaque white reflector should be provided for each lamp in order to prevent dispersion of the light in the opposite direction to that in which it is required. The use of a properly made reflector is an important point. Generally, more pleasing lighting is obtained by the use of a number of 500-watt lamps than by one or two 1,500-watt lamps.—"B.J.," April 27, 1917, p. 227.

Space-Saving Background Arrangement.—W. Marshall has designed an arrangement for holding two backgrounds in a studio where space is limited, but where the grounds are required to be quickly exchanged. The grounds are mounted on frames, which are hinged in one corner, A, of the room. The white background, AB, when in use, completely covers the black ground, ACD, which is of greater width (sufficient for groups of two or three persons), but the frame of which is made in two parts, hinged together so that the

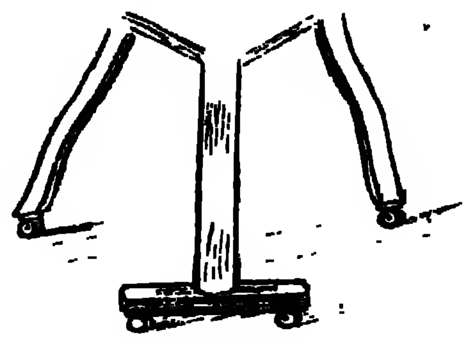


Background Arrangement.
A B, White ground, A C D, larger Black ground on hinged frame.

smaller portion, CD, can be folded behind, yet can be readily brought out to the full width. When the black ground is in place for working against the back wall, AE, the reverse side (also white) of the white ground is turned round into the dotted position, Ab,

and there renders service as a reflector. The whole arrangement is most speedily handled, and when the white ground is in the working position no sign is shown of the black ground behind it, the grounds having sufficient space allowed between them for the rolled up foreground.—"B.J.," March 30, 1917, p. 163.

Free-Moving Studio Stand.—M B., as a means of rendering the ordinary three-footed studio stand freer in movement on the studio floor, has fitted a cross-foot to the front leg of the stand. This foot being fitted with two castors (ball-bearing), the stand is equal in safety and ease of working to one with four feet. The stand with



its camera can then be swung into any position quite easily with one hand. The piece is of red deal, measuring 2½ ins. by 1½ ins., and 7½ ins. long, nicely shaped, with a hole morticed in the centre, the shape of, and to receive, the foot of front leg. To secure perfect rigidity, right-angle brackets, 4½ ins. upright by 3½ ins. on the horizontal, are screwed on both sides to leg and foot, castors are then fitted to bottom side of foot near each end, and all coloured to match colour of stand.—"B.J.," June 1, 1917, p. 289.

Firelight Portraits by Electric Light.—H. Essenhigh Corke points out the great convenience of electric light in the making of portraits showing the sitter seated near to a fireplace (artificial) and under a lighting resembling that of firelight, as described in "B J.A.," 1908, p 602. According to the former method daylight was used, and thus necessitated a platform for the sitter in studios where the glass did not reach down to the floor level. For use with electric light such as the "Northlight" lamp or an installation of half-watt lamps (see earlier in this Section) a mirror of any ordinary quality and about 2 ft. square is placed on the floor below the lamp so as to reflect the light upwards on to the sitter. Most of the direct light from the lamp on to the sitter requires to be screened off with a blind so that the sitter receives only weak diffused illumination from this source. A dark background is always employed, and requires to be screened off from both the direct and reflected light. In the studio this means that the sitter requires to be posed as far from the background as the length of the studio and the focus of the lens will permit While the exposures are short, hardness due to

under-exposure must be guarded against. The negative should be bright and crisp with detail in the shadows but with every detail in the high-lights Thus development should be for these high-lights, letting the shadows take care of themselves —" B.J.," May 4, 1917, p. 232

Sketch Portraits.—J. Spencer Adamson has dealt in full detail with the making of sketch portraits, including the suitable studio lighting, working up of the negative, appliances for making the prints, and, particularly the working-up, clouding, and introduction of sketch work.—" B.J.," June 22, p. 326, and June 29, p. 342, 1917. (These articles have since been re-published as a sevenpenny manual by Messrs H. Greenwood and Co., Ltd.)

LIVING PORTRAITS.

Living Portraits.—A further number of patents have been published describing apparatus for the making of "living portraits" by the method of obtaining three separate records of a sitter (each with a different expression distributed in band form over the negative by means of a ruled screen placed in contact with the plate in the camera and shifted slightly between each of (usually) three successive exposures. (See " B.J.A.," 1917, p. 359 for a graphic description of the principle of this method.)

W. E. Allan has described a dark slide or plate-holder designed to hold both the ruled screen and the sensitive plate, and to allow of the one being moved in reference to the other by means of a cam mechanism. Eng. Pat. No. 102,471. " B.J.," January 26, 1917, p. 47

M. A. Pyke has patented a mount for holding the composite banded print and the ruled celluloid screen, one feature of which is the use of a springy packing of cotton-wool or other material such as corrugated paper, for the purpose of keeping the print in close contact with the screen. A tab projects from the mount, and by working it up and down the screen is caused to move to and fro in a parallel manner over the print through a minute distance. Eng. Pat., No. 105,401.—" B.J.," May 18, 1917, p. 265.

J. M. F. Pons and A. M. y Perez have patented a loose back for attachment to an ordinary camera and provided with an inner frame holding the ruled screen. This frame can be moved parallel with itself to and fro through a minute distance by means of a micrometric screw on the outside of the back. Eng. Pat. No. 105,365.—" B.J.," May 25, 1917, p. 277.

Living Portrait Mounts.—A. E. Walsham, A. Bennett, and A. H. F. Perl have designed a form of mount for holding the banded photographic print behind a ruled celluloid screen. The movement of the screen over the photograph is obtained by having the screen secured to an intermediate frame which is caused to move slightly

to and fro by pressing and releasing a slightly elastic knob, such as a short piece of rubber tubing, which projects slightly from the back of the mount. Eng. Pat. No. 106,681.—"B.J.," July 13, 1917, p. 368.

Living Portrait Camera.—A. E. Walsham, A. Bennett, and A. H. F. Perl have patented a detachable camera back designed to hold the sensitive plate and also the ruled screen, a cam mechanism providing for a minute shift of the screen in reference to the plate by moving a lever placed outside the back and setting it at given points upon a graduated quadrant. Eng. Pat. No. 106,680. "B.J.," July 13, 1917, p. 367.

Living Photographs.—Mounts for living portrait photographs have been patented by A. M. y Perez. According to one form the card on which the photograph is mounted is provided near its two longitudinal edges with slits which are engaged by tongues formed on the edges of another card having a central opening covered by a lined transparent plate. With this construction the relative movement necessary to produce the effect of animation is obtained by moving the thumb and index finger between which the device is held.

Another form comprises a card carrying a lined transparent plate, and provided with outwardly extending tongues which engage in grooves formed by folding inwardly the outer edges of a card carrying a composite photograph, one of the cards being provided with a projecting strip to facilitate movement thereof relatively to the other card.—Eng. Pat. No. 102,929: "B.J.," Oct. 12, 1917, p. 525.

Flashlight.

Speed, Etc., of Flashlight Powders.—J. I. Crabtree, of the Eastman Research Laboratory, has described measurements of the speed of burning of flashlight powders. The measurements were made by means of the cinematograph shutter testing apparatus briefly described in "B.J.A.," 1917, p. 326. The following general results were obtained :— Powders prepared with aluminium burn very much more slowly than those with magnesium. The speed of burning may be varied very greatly by the choice of oxidising agents (chlorate, etc.), and by the use of a suitable retarder. None of the ingredients of the powder should be active absorbers of moisture, otherwise the powder, if it stands in an open flash-pan for any considerable time previous to firing, will absorb moisture and will burn much more slowly. The finer the degree of division of the magnesium the more rapidly the powder burns. In the case of a powder made up with three parts magnesium, six parts potass. chlorate, and one part antimony sulphide, the speed of combustion was 1/8th second when the magnesium had passed through a 90-120 mesh sieve, and 1/16th of a second when sieved to the extent of 150-200 mesh. The former

is a coarse powder; the latter, fine. Using aluminium in place of magnesium in the above formula the time of combustion was four times as long. Thus while a fine magnesium powder yields a more efficient mixture, the latter does not keep so long as one made with coarser magnesium owing to the greater tendency of the metal to oxidise when in a state of fine powder. In any case the magnesium oxidises on the powder being kept, especially if one constituent of the powder absorbs moisture actively. Each grain of the powder thus forms a layer of oxide, which tends to prevent rapid combustion.

The larger the quantity of powder which is burnt the lower the speed of combustion. Actual figures are :—

Nature of powder.	Quantity of powder fired.		Speed. Sec.
Fast powder............	5 gms.	....	1-11
	10 gms.	....	1-8
	15 gms.	....	1-7
Slow powder	5 gms.	....	3-10
	10 gms.	....	4-10
	15 gms	....	7-10

By means of the cinematograph apparatus Mr. Crabtree has also studied the blinking action of the eyes when a portrait is made by flash-light. The brilliant flash causes the eye to adjust itself by contraction of the pupil, and by a closing of the eyelid (a blink). There is a definite time interval between the stimulus—that is the flash—and the effect—that is the blink—which varies slightly with individuals, but is usually about 1-12th of a second, so that if a blink occurs before the effective flash is ended it is apparent on the negative, while if the speed of the flash is such that the effective flash does not last longer than 1 12th of a second, the trouble from blinking is obviated.

This reflex period varies with different persons, but in no case was it found to be shorter than 1-12th of a second.

In flashlight portraiture it is important to focus under fairly normal lighting conditions in order that the pupils of the eyes may not be unduly dilated at the instant of the flash. They will be so if the sitter is in almost darkness, and the flash portrait will then show a very unpleasant staring effect of the eyes This is in no way due to the flash, but simply to a condition of darkness prevailing immediately before the flash. The sitter should be illuminated sufficiently to produce an appearance of the eyes similar to that in ordinary weak daylight.

The flash powder should burn in less time than 1/12th of a second, and the shutter on the camera should be opened only just before the flash in order to avoid the formation of a double image on the plate should the sitter chance to move before the operation of the flash.—"B.J.," Jan. 19, 1917, p. 29.

Electric Multi-Ignition.—Colin N. Bennett describes the construction of an electric igniter suitable for firing several lots of flash powder at the same instant. The chief point in making it is the proper construction of the fuses, and the arrangement of the wires. The fuse is shown at G in the drawing. The shanks are of copper wire, about 20 gauge. Fastened between them is a piece of fine iron wire about 1 cm. (or just under half an inch) in length. The ends are first twisted round the copper shanks, and then made fast by soldering. A dozen or two of these fuses should be prepared at a time. The iron wire is that sold for florist's use. It must be iron, and very fine. That is the only thing to make sure of.

If a fuse made as already described is short-circuited between the terminals of an electric accumulator such as is sold for use upon motors and motor cycles, the iron wire will at once glow almost white hot, and in a second or so will melt. If at the time the fuse is 'shorted' it is plunged in flash powder, the powder will be ignited instantly. Further, the explosion of the powder will be thorough, and the force of it will shatter the fuse wire, so protecting the accumulator plates from injury due to too sudden a discharge.

For igniting a single heap of flash powder, therefore, the connections between fuse and accumulator are simple. Run an insulated—that is to say, covered—electric cable from one terminal of the accumulator to one shank of the fuse. Attach another suitable length of electric cable to the other shank of the fuse, and bring this to a short length of electric flex wired to an electric bell "pear push." The other wire of the flex leading into the "push" is connected by cable to the remaining free accumulator terminal.

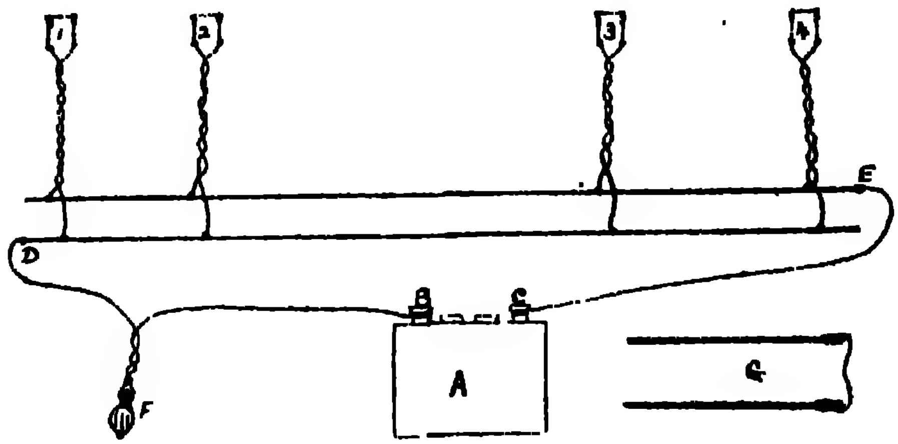
It does not matter which terminal is used for each end of the circuit so long as the wiring makes a complete circuit, or loop, between the two accumulator terminals. The fuse will be heated and the flash powder exploded by firmly pressing the knob of the pear push.

For simultaneous firing of two or more lots of powder adopt the method of wiring shown in the sketch. When carried out according to the illustration, it allows an equal electrical path, and, therefore, equal electrical resistance between the accumulator and each fuse, of which four are here figured. D and E are trunk wires. They do not touch each other at any point, but from them the electric connections to either shank of each fuse are taken as branches. It is important that each branched or parallel fuse connection should consist of the same length and gauge of covered wire. From D and E wires run to the terminals B and C of the accumulator A. The pear push for igniting the flash powders is shown at F, but may be included at any point between B, D, and C. E, as may be most convenient to the photographer; not elsewhere.

Upon pressing the pear push each fuse, irrespective of the number, will receive exactly the same current fed to it, and will ignite the flash powder it serves at exactly the same moment. The main cables, E and D, are represented as straight lines in the drawing, but may, of course, be bent around as required for correctly disposing the flashes.

The best sizes of electric cable for wiring up fairly long flashlight ignition circuits are 3/20 or 7/22 gauge electric light cable. Both sizes are inexpensive to buy, and light in weight. 7/22 is the larger.

Wherever possible wiring joints should be soldered, but actually it will be found enough to bare and brighten the wires and make a



tight twisting joint with the aid of a pair of wire pullers. Insulate the joint with a covering of electrician's adhesive tape.

The sort of accumulator best suited for multi-flash work is a six or eight-volt one of not less than twenty ampère hours capacity. Be sure it is fully charged!

Before arranging the flashlight powders asbestos sheets should be placed in the metal trays. This will prevent the fuses coming in contact with the metal. Otherwise the current might flow through the metal tray instead of through the fuse wire, and ignition would then not take place. If diffusing screens are used before the flashes they may be made of thin muslin stretched over light metal frames. The muslin can be rendered quite fireproof by first soaking it in a hot 5 per cent. solution of gelatine containing 5 per cent. of ammonium chloride, wringing out, and stretching the material to dry.—"B.J.," January 26, 1917, p. 46.

Flashlight Powder.—In a German patent, the use of finely-divided rare earth metals such as zirconium, thorium, and titanium, in admixture with their nitrates or perchlorates, is claimed by E. Wedekind and Geka-Werke of Dr. G. Krebs.

Copying.

Positives Direct on Bromide Paper.—In the making of direct camera copies of letters and other documents on thinly coated colour sensitive bromide paper such as is employed in copying machines like the Photostat and Cameragraph, the copy may be obtained in positive form by a process of reversal similar to that used in the Autochrome process.

The exposure must be sufficient so that development is complete in about two minutes, using the developer recommended for the particular paper used. After washing the print for five minutes it must be bleached by bathing for one minute in the following bleach bath:—

Potassium permanganate ...	30 grs.
Sulphuric acid (strong)	150 minims
Water ...	32 ozs

Rinse and immerse in a dilute solution of sodium bisulphite to remove the brown stain, working in full daylight and rinse and develop in the developer first used, then fix and wash in the usual way.

Any slight stain that remains in the print can be removed by bathing in a weak solution of potassium cyanide, being careful to take the print out the moment the stain disappears, or the silver image itself may be attacked.

A second method, worked out in the Research Laboratory of the Eastman Kodak Company, calls for developing in the usual manner, converting the unexposed silver bromide into silver sulphide and then removing the residual silver image, leaving a positive image of silver sulphide.

The exposure may be made in an ordinary plate holder, keeping the paper flat with a sheet of clear glass, and must be adjusted so that development is complete in two to three minutes in the following developer at 70 degrees F.

Elon		8 grains
Hydroquinone		150 grains
Sodium sulphite	3 ozs	100 grains
Sodium carbonate	3 ozs	100 grains
Potass. bromide		50 grains
Water		32 ozs

This developer will keep well.

It is evident, in view of the fact that this developed silver image is subsequently removed leaving a clear white background, that all the exposed silver bromide must be reduced to silver during development, or the high-lights of the final positive will be stained or fogged. On the other hand if the print is over exposed in the first place, spreading may take place and fine lines will be lost.

After development a rinse only is needed before the print is put into the darkening bath, where it remains for two minutes at 70 degrees F., when the unexposed silver bromide is converted into sulphide. The bath is made up of:—

Sodium sulphide (Crystal)	1 oz	330 grains
Water		32 ozs

It will be safer to bring this solution to the boiling-point and allow to cool before using, in order to precipitate the iron present. The final colour of the print, as well as the degree of contrast, will depend on the strength of this bath, which may be used almost indefinitely. A weaker solution will give yellowish-green tones, but if the above strength of the solution is maintained, almost black

lines are obtained. Rubber finger tips should be worn, as the solution may affect the finger nails.

The print, after a few seconds washing, should be placed in the following bleach bath until the high-lights are perfectly clear, which will occur in about three or four minutes—

Potassium ferricyanide	11 ozs.
Ammonium sulphocyanide	11 ozs.
Water to	32 ozs.

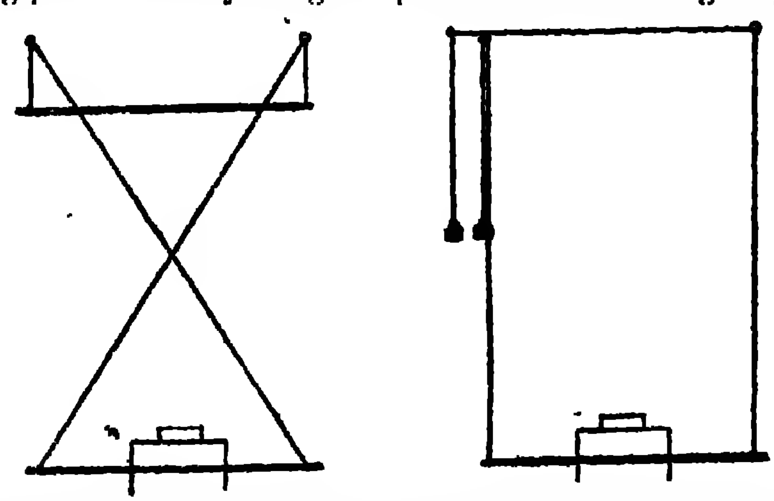
The temperature of the bleaching bath is important. It may run from 65 to 75 deg. F., but it should not go beyond this, or the silver image may be attacked and the bath is liable to decompose. The bath ripens with age, and works best when it has turned a greenish colour. Ammonium sulphocyanide may be replaced by the potassium salt without changing the action.

In view of the fact that ammonium sulphocyanide dissolves silver bromide, the print is automatically fixed during bleaching. After bleaching, the print should be well washed for five or ten minutes and dried as usual.

The finished print will have a slightly yellowish cast in the high-lights, which can only be removed by continued use of the ferricyanide bath, which is not desirable. Local yellow stains are due to the presence of silver bromide along with the silver image previous to sulphiding. It is important, therefore, to prevent this by correct exposure and full development. At all stages of the process the print must be agitated to prevent stains caused by uneven action of the baths.

In actual practice the process takes very little time. Not more than twenty minutes are needed to carry it through, including the developing, sulphiding, bleaching, and washing.—"B.J.," Feb. 9, 1917, p. 68.

Parallelism of Original and Camera.—D. Charles describes the following process of adjusting the parallelism of an original, such as



a painting fixed on a wall, when photographing it in the ordinary way. A couple of screw-eyes are put in the top corners of the

copy-board or, if it is convenient, high up in the wall above the board. Two sticks are required, each about a yard long, and two equal lengths of cord tied to them near the ends. One of the rods is arranged to hook on to the camera, on top for preference, so that it can be put on and taken off easily, and to project quite equally on each side. The drawing shows how the strings are run through the screw-eyes, letting the other rod hang loose When the camera is square with the copy the loose rod will hang level, but not otherwise.

In cases where large originals are handled, an extra screw-eye and longer cords are arranged, as in the second sketch, with a small weight at the end of each. The camera is arranged square with the wall by any known method, and the weights tied just even one with the other, and they will remain so, whatever the distance of the camera. When the weights are not level, the camera needs moving to one side or the other, and can be corrected much more quickly than by any other means.—"B. J." Jan. 5, 1917, p. 6.

Exposure Meters.

Exposure Meters with Subject Scale.— C. Macnamara emphasises the convenience of an exposure meter embodying a scale by which the exposure for various subjects can be directly read off without the necessity of making a separate allowance for it. In the case of the Imperial meter the subject is pasted over that bearing the figures for various H and D plate-speeds, the figures being chosen for a plate of 250 H and D. He provides for five subjects, viz., sky (No. 1), snow and sea (No. 2), light foreground (No. 3), normal (No. 4), and dark objects (No. 5). In this order, each subject requires double the exposure for the one preceding. In modifying the Imperial meter in this way, the method is as follows :—

Taking the position of factor No. 4 "Normal" as the starting point, against whatever Actino. number it may be placed—

Factor No. 5 must be opposite an Actino. number of half the value.
Factor No. 3 must be opposite an Actino. number of twice the value.
Factor No. 2 must be opposite an Actino. number of four times the value.
Factor No. 1 must be opposite an Actino. number of eight times the value.

In applying this system to the Watkin's Bee meter the plate-speed scale of which merges with the exposure scale, a subject scale cannot be used for plates slower than about Watkin's 90, otherwise needed exposure figures will be covered up. But with a more rapid plate only shutter speeds which are very seldom required will be put out of use.

As with the Imperial meter, the "Normal" factor No. 4 is marked immediately over the speed number of the plate used. The position of the other factors can then be readily determined by the f numbers of the inside scale. Thus if "Normal" is placed opposite f/16, factor No. 5 (Dark objects) should be opposite f/11,

factor No. 3 opposite $f/22$, factor No 2 opposite $f/32$ and factor No. 1 opposite $f/45$

Obviously the new scales necessitate no radical change in the working of the meters. In the case of the Imperial meter, the appropriate subject factor is set against the indicated actinometer time, and the exposure is read opposite the stop in use With the Watkins Bee meter the subject is set opposite the stop, and the exposure is shown opposite the light-value as usual – "B J.," July 6 1917, p 351

Lieutenant Paul Tupp in reference to the above suggestion, describes the fitting of a subject scale to the ordinary Watkins Bee meter as follows —Mark the "corner" of the meter with the five points by notching with a small file in the required places, considering 180 as normal Carry a line across the side from each of these points towards the back, and put the lettering on the side of the meter There is more room for it here than on the rim round the face of the dial, and this method requires no fitting and none of the figures are obscured.

As regards the actual lettering it is quite easy to do this by "dotting" the letters with a sharp steel point, afterwards rubbing in a little black pigment (as a matter of fact, a dirty finger will do all that is required) "B J," September 21, 1917, p. 490.

Harvey Exposure Calculator —Details of the construction of an exposure calculator indicating exposures in all ordinary latitudes for plates of various speeds and, simultaneously, for eight classes of subject and seven diaphragm apertures are given in the inventor's patent specification Eng Pat No 102 872 "B J," February 9 1917, p 70

Miscellaneous Subjects.

Recording Finger prints The Eastman Kodak Company has devised a process for the making of photographic records of fingerprints which consists essentially in greasing the finger with vaseline, wiping off all the excess of vaseline, and pressing the greasy finger on a previously fogged sensitive plate The plate is then placed for a period of from ten to thirty seconds in a developing solution which attacks the photographic emulsion and turns it black with the exception of that part covered by the vaseline, which is unchanged. Obviously, the reason for this is that the vaseline is insoluble, and for a short time prevents the developer from working through to the emulsion. The plate is next fixed in hypo the time of fixing being from six to ten minutes longer than usual in order to allow the hypo to get at the emulsion under the vaseline. The vaseline is finally wiped off with cotton and the plate washed and dried. A negative is thus provided from which any number of photographic

prints can be made. The process of preparing the plate can be carried on anywhere in ordinary daylight without the use of a dark room. If one or two records only are desired the finger impressions can be made directly on previously fogged photographic paper, developed and fixed in the usual way.—"B.J.," July 27, 1917, p. 392.

Photography of Quinine Writing.—The use of solution of quinine as a means of making invisible writing or drawing which can be easily rendered visible by photographing it is still often referred to in text-books, although the process with present day plates and lenses is practically valueless. Quinine fluoresces in ultra-violet light, that is to say, the invisible, very actinic ultra-violet rays, when they fall upon the quinine, are converted into visible, less actinic rays. The unmarked parts of the paper, therefore, still reflect ultra violet rays, and thus differ actinically from the writing. Thus, in viewing or photographing the original by light which consists wholly or chiefly of ultra-violet rays the writing becomes visible. In daylight, however, there is such a preponderance of visible actinic light that the difference is lost, the writing reflecting practically as much visible light as the paper and therefore photographing almost as readily. By the light of a mercury vapour lamp or the enclosed arc (light sources which are richer in ultra-violet rays), the difference is greater. But even then it is not very easy to obtain a strong record of the writing on a photographic plate owing to the absorption of ultra violet light by the glass of the lens. For this, a quartz lens is necessary.—"B.J.," Jan. 5, 1917, p. 3.

Photographing Gun Fire.—J. A. Wilson, instructor in photography at the U.S. Coast Artillery School, Fort Monroe, Virginia, has described the electrical device used by him in releasing the camera shutter simultaneously with (or a fraction of a second after)

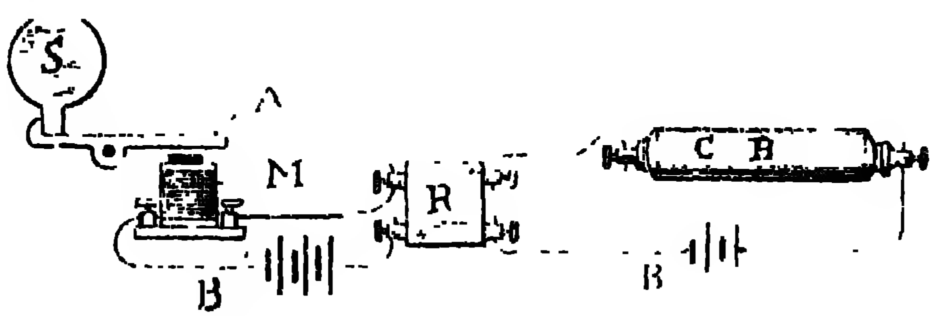


Fig. 1.—Improved release with timing relay.

the firing of large guns for the purpose of showing the form of the discharge and the course of the projectile.

As shown in Fig. 1, the shutter setting lever is engaged by a hook on the end of arm A, held in place by the magnet M. The circuit breaker, C B, operating by inertia, is bolted to the side of the gun

or carriage, and has a uniform action for all kinds of guns, breaking the circuit the instant the gun moves. This device consists of a tube about 6 ins. long and ⅞ in. in diameter, with a cap, provided with binding posts, at each end The screws of these last extend through and are insulated from the caps, and form electric contact with the plunger, which is slightly smaller than the diameter of the tube. At one end is a spring, just strong enough to hold this plunger in contact with the other cap when the tube is in its normal horizontal position, the slightest jar or movement breaking the circuit.

Anyone trying this class of work will do well to provide himself with a few extra ground glasses in case of damage to the focussing screen by the concussion due to the gun firing. Too rigid a tripod will cause other troubles, such as front board jumping out, plates falling forward into the camera, and the like. One should use an old style folding tripod that will itself absorb most of the shock. However, a few glazier's points will prevent plate falling out, and a little tightening up of the buttons will hold the front board in place, and these precautions should be observed. With some modifications that will naturally suggest themselves, this device could be used to photograph any rapidly moving object that was required to be caught at a certain point in its travel. For example, an automobile moving at a high rate of speed in order to show the effect of the tyre on the road bed.

In the circuit between the circuit breaker and the magnet controlling the shutter is placed a relay, shown at R, in Fig. 1, and in

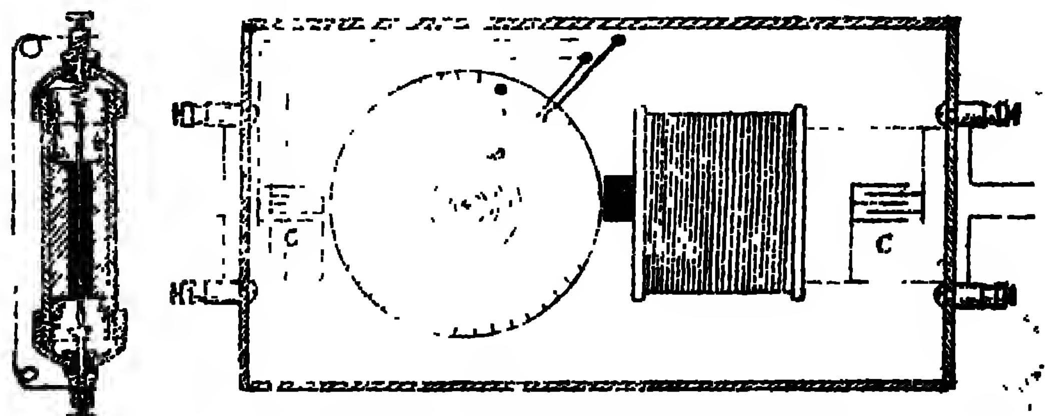


Fig. 2.—Circuit-breaker and timing relay in detail.

detail in Fig. 2. The essential parts are a pivoted iron disc, a clock spring to actuate it when released, an electro-magnet to hold it in any position set, and two condensers, shown at C C, one in each circuit. The iron disc revolves freely on the pin or axle, its edge just clearing the pole of the magnet. The clock spring is of such tension that it causes the disc, when released, to make a complete revolution in about 1-25th sec. Therefore, as the circumference moves through five degrees of the circle, it delays or retards the break in the second or shutter circuit long enough to allow the pro-

jectile to travel about 5 or 6 ins., depending upon the muzzle velocity of the latter. With the circuit closed the disc is rotated backwards the desired number of degrees, where it is held by the magnet. When the circuit is broken by the jar of the gun, the magnet releases the disc, and the latter turns ahead until the stop pin S strikes a spring contact and opens the other circuit to the shutter. By means of this relay the circuit through the shutter magnet may be broken at the same time the circuit breaker opens, or the action may be delayed a pre-determined length of time ranging from nothing to about 1-25th of a second. To test the accuracy and uniformity of the timing of the relay it was set in the same position on a mortar on three different occasions.—"Camera Craft," Oct., 1916, p. 596. "B.J.," Nov. 3, 1916.

IV.—NEGATIVE PROCESSES.

The Gelatino-Bromide Process.

PLATES AND EMULSIONS.

A Review of Photographic Manufacturing Processes.—A report by B. V. Storr, published by the Society of Chemical Industry, deals with recent progress in photographic manufacture as regards raw material such as gelatine, glass, and paper, emulsions for plates and papers, processes of colour photography and colour cinematography, developing substances, together with the chief papers dealing with the scientific and theoretical side of photography, including the measurement of plate speeds. The report is published in "B.J.," July 6, p. 353, and July 13., p. 364, 1917

Recovering Silver from Emulsions.—F. F. Renwick, B. V. Storr, and Ilford, Ltd., have patented processes for recovery of silver from diluted photographic emulsions, the method broadly consisting in first allowing the emulsion to "age" by standing for a day or two at the ordinary temperature (or by cooling it to 45 degs. F. in place of allowing it to stand), and then adding a substance such as iron perchloride in order to precipitate the silver. Eng. Pat. No 16,708, 1915.—"B.J.," December 29, 1916, p. 710

The same patentees, in a later specification, have described an improved process consisting of adding to the emulsion two or more substances, the effect of which is to produce a flocculent precipitate by which the silver is carried down. Substances which are suitable for this purpose are hydrated alumina, ferric hydrate, resin, casein, etc., precipitates of these substances being produced according to

well known methods. Thus, the two additions may be alum and ammonia (to produce hydrated alumina) or resin soap or casein in ammonia and hydrochloric acid, in order to produce resin and casein respectively. Eng. Pat. No. 102,668.—"B.J.," December 29, 1916, p. 710.

Orthochromatic Processes.

Optical Properties of Light-Filters. Dr. C. E. K. Mees, in a paper from the Eastman Research Laboratory, has published tests and measurements showing the distortion produced in the image formed by a lens by the use of light filters of greater or less degree of optical perfection. "B.J.," Sept. 7, 1917, p. 462.

British Colour Sensitisers.—Processes for the manufacture, upon a scale sufficient for the requirements of British makers of orthochromatic and panchromatic dry-plates, of colour-sensitisers replacing the previously used German dyes have been worked out by Professor W. J. Pope, of the University of Cambridge. These dyes are supplied under the trade name of "Sensitol" by Messrs. Ilford, Limited.—"B.J.," Jan. 12, 1917, p. 25, and Jan. 26, 1917, p. xi.

New Colour-Sensitising Dyes.—Dr. Eder has tested the sensitising properties of certain new dyes produced in the Hoechst factory under the superintendence of Dr. E. Konig. They are dicyanine A, pinachrome blue, pinachrome violet, and pinacyanol green. Few details are given of the chemical constitution of these dyes—which, it is stated, have been patented—but the pinachrome blue is said to be a pinacyanol with one OC H group. Chemically, it stands in the same relation to pinacyanol as does ethyl red to pinachorme. Dr. Eder has made a spectrographic examination of these new dyes in comparison with those previously in common use, namely, dicyanine, pinacyanol, etc., and selects for mention as of special value the dicyanine A and the pinachrome blue.

Dicyanine A is a greenish blue dye, an ethoxy derivative of dicyanine. It is fairly soluble in hot alcohol, and remains in solution on mixing with an excess of alcohol containing water. As a sensitiser for gelatino-bromide plates, its action extends further into the red and infra-red than dicyanine—to 780 to 630 $\mu\mu$ in the dark red, and somewhat weakly up to 850 $\mu\mu$ in the infra-red. Its minimum from the orange to the yellow and green is, however, more pronounced than in the case of dicyanine. In the photography of weak spectra it is necessary to use dicyanine A in conjunction with ammonia, and the keeping qualities of the plates are then poor.

Pinachrome blue is described as an excellent sensitiser for from dark red to orange and as far as the yellow-green. Its sensitiveness does not extend so far into the dark red as does that of dicyanine, beginning about the line A and extending with a slight depression in the orange to D½E in the yellow-green.

Pinachrome violet is a dye which in its colour-sensitising action is very similar to pinacyanol. It is a strong sensitiser for red from the line A through the orange and yellow into green. About $C\frac{1}{2}D$ is a small minimum, and a pronounced minimum, in the green. In comparison with pinachrome blue, the sensitising action does not extend so far into the dark red, but between C and D the sensitising action is more even. By addition of ammonia, the general sensitiveness is increased some four or six times, but the plates then tend towards fog. Dr Eder prefers pinachrome blue to pinachrome violet, whilst he finds no special advantage in pinacyanol blue.

His general conclusion is that for photographing from the infra red to the red the best sensitiser is dicyanine A, in conjunction with ammonia; more extended sensitising action, not quite so far into the infra red, but, on the other hand, extending further towards the orange, is supplied by ammoniacal dicyanine. From the limit of the infra red and dark red to the yellow the most satisfactory results were obtained with pinachrome blue used without ammonia, although this addition enhances the general sensitiveness. From yellow to green, and including also blue and violet, preference is given to pinaverdol. These colour sensitisers just mentioned, provide the means of covering the whole visible spectrum, and of including also the infra red (from 850 $\mu\mu$ to 530 $\mu\mu$) without difficulty in spectroscopic photography.—"B.J." "Colour Supplement" (from "Phot. Korr."), Feb. 2, 1917, p. 8.

Developers and Development.

Developer Formulæ.—Dr. C. E. K. Mees has suggested that uniformity and ease of comparison of developer formulæ should be secured by use of a notation in which R stands for the reducing agent, A for the alkali, S for the sulphite, and B for the bromide, i.e., the constituents should always be written in the order R, A, S, B. R should be replaced by P, H, etc., denoting pyro, hydroquinone, etc., A by the particular alkali, and so on. After each letter the weight of the chemical (in grams) contained in 1,000 ccs. of water should be stated—in reference, presumably, to the working developer. The hydroquinone and caustic potash developer commonly used in process work would thus be: H12 KOH25-Meta 25 B 12.5.—"B.J.," Oct. 19, 1917, p. 535.

Monomet Developer.—T. H. Greenall has made a comparative working test of Monomet alongside metol. Using a developing solution containing 1 grain of Monomet to the ounce he found that in comparison with metol made up according to a similar formula the Monomet continued to develop gaslight prints satisfactorily to a larger number than metol. The prints developed with Monomet were markedly superior in brilliancy and strength. In comparison with metol the image on bromide paper was a little slower in appearing in the Monomet developer, but the total time of development was practically the same with each developer. The same thing is observed with gaslight papers, and with both gaslight and bromide

papers the strength and colour of the prints was better.—"Phot.," Feb. 6, 1917, p. 95.

Monomet-Hydroquinone Developers.—Various users of Monomet have published formulæ for the making of a fairly concentrated single solution developer of Monomet and hydroquinone capable of being diluted with several times its volume of water to form the working developer. One such formula (by A. W. Holliday) is :—

Monomet	10 grs.
Soda sulphite	1 oz.
Hydroquinone	30 grs.
Soda carbonate	¾ oz
Potass bromide	60 grs.
Boiled rain water	28 ozs.

In making the working developer for postcards and papers, the above stock solution is diluted with an equal bulk of rain water. In developing, keep the temperature up to 68 deg. F., but not over 70 deg F For plates, the stock solution is diluted with very little water and used at a temperature not over 65 deg. F. There are two precautions necessary in regard to this formula. The first is to dissolve the chemicals in boiling water, and then to add them, in the order named, to about half a gallon of water, and make it up to a gallon after The keeping qualities seem to be good. The stock may be kept a fortnight in an open jug, with no ill results. The other precaution is to see that the worker who does the developing also does the washing This, to avoid action on the skin

A quick acting and very concentrated developer may be prepared according to the following formula of the White Band Company. This contains caustic soda, though not to a large amount, and should not be found to cause skin irritation, or blisters, or frilling :—

LIGHTNING DEVELOPER.

Monomet	8 gms. or 70 grs.
Hydroquinone	8 gms. or 70 grs.
Soda sulphite cryst	60 gms. or 528 grs.
Potass. bromide	1 gm. or 8 grs.
Caustic soda	5 gms. or 44 grs.
Water to	500 c.c. or 10 ozs.

S A Noble recommends the following formula for a single solution developer requiring to be mixed for use with an equal bulk of water :—

Monomet	512 grs.
Hydroquinone	960 grs.
Sodium sulphite cryst.	12 ozs.
Sodium carbonate cryst	16 ozs.
Potass. bromide cryst.	64 grs.
Water	2 gallons.

This makes a perfectly white and clear solution, which keeps well.—"B.J.," Aug. 24, p 442, Aug. 31, p. 455, Sept. 7, p 467, Sept. 14. p. 478, 1917.

Acid Amidol.—The following is recommended as a formula for the acid amidol developer, possessing the advantages claimed for developers of this kind, namely, good keeping qualities and superior gradation, etc., in the negatives:—

Water (boiled)	20 ozs.
Sodium sulphite (cryst.)	$1\frac{1}{2}$ ozs.
Sodium bisulphite lye	10 drams.
Amidol	60 grs.
Potass bromide	5 grs.

In using this developer the worker must not be misled by the apparent great density obtained in the first few minutes. If removed at this stage the negative will be much too thin. Development should be controlled by time or density judged by the general darkening at the back.

The bisulphite lye in the formula may be made by adding $\frac{1}{2}$ oz sulphuric acid to 7 ozs. water, then adding 4 ozs. soda sulphite cryst., and shaking until dissolved.

Another point is to use developer not colder than 60 or 65 degs. F : at low temperatures, acid amidol becomes almost inert.—"A.P.," July 16, 1917, p. 35.

Amidol Stain.—E. F. Dowty finds that the "Ore Solvent," sold by ironmongers and dealers in motoring requisites, is a good means of removing pyro and amidol stains from the finger-nails. The nails should be well rubbed with the preparation—"B.J.," Feb. 16, 1917, p. 89.

Pyro-Amidol Developer.—For hand-camera exposures, where plates or films are most probably somewhat under-exposed, T. H. Greenall has worked out a system of using amidol in conjunction with a pyro developer made up with a minimum of alkali He uses a two-solution pyro formula prepared as follows:—Solution A : 80 minims of diluted sulphuric acid (1 part acid in 10 of water by volume) are mixe in a 4-oz bottle with 4 ozs of cold water; 260 grs. of soda sulphite cryst. is then added, the bottle corked, and the sulphite allowed to dissolve, when the pyro is added. Pyro solution made in this way keeps very well. In place of the sulphuric acid, 30 grs. of metabisulphite may be used.

The alkali solution (B) is made by dissolving 1 oz. of soda carbonate cryst. in water to make 9 ozs.

The working developer consists of 2 drams A, 2 drams B, and 4 drams of water.

The amidol solution is made as follows:—Solution A : Soda sulphite cryst., 120 grs.; water to make 8 ozs.; amidol, 16 grs.; crystallised oxalic acid, 40 grs. These are dissolved in the order given. After adding the oxalic acid, the solution is shaken until the crystals of acid dissolve and a little longer—an occasional shake is sufficient—as a precipitate forms, and the mixture should not be left at rest while the precipitate forms. This should be labelled: "Shake the bottle before using." It was not found possible to make an amidol

solution which will keep without having this precipitate. The precipitate is active, and care must be taken always to get a proper proportion of precipitate when the solution is measured out. The mixture keeps indefinitely.

For use with the amidol A solution, the B solution given above for pyro may be used, or, as an alternative, a solution of soda sulphite. The working amidol developer is.—Solution A: 4 drams; soda sulphite, 15 to 20 grs.; or sodium carbonate, 8 to 10 grs.; with water to make 1 oz. of developer. If sulphite is used, the working mixture will keep clear for a day or two, and is an excellent developer for bromide. With carbonate it soon begins to discolour. More alkali makes the developer too rapid.

The pyro-amidol formula is:—

Pyro working developer as above	1 oz.
Amidol working developer ..	1 dram

If this works too softly, ½ dram only of the amidol working developer may be used.

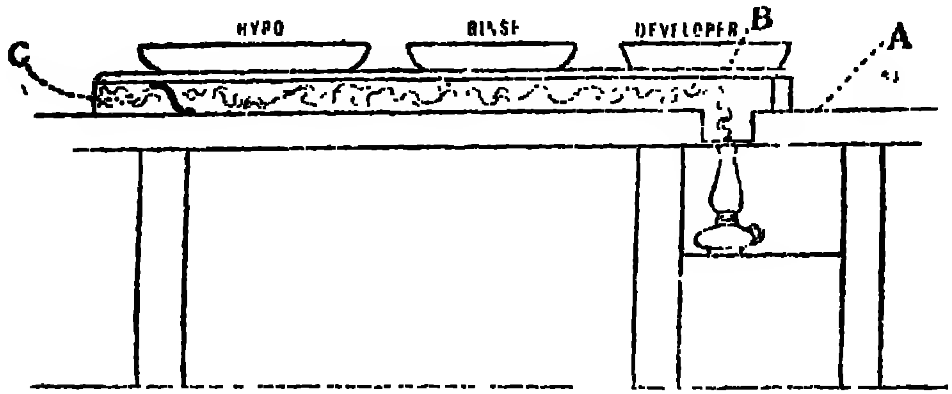
In using the developer, the required amount of amidol developer is placed in a measure ready to hand together with a separate dish, as if the slightest trace of amidol got into the pyro dish it is obvious that the rapid appearance of the image would mislead the operator. The plate is then flooded with pyro, and in forty-five seconds, depending on the make of plate, one will be able to tell whether the plate has been over or under-exposed. In the former case development may be continued in the pyro. In the latter the developer is poured into the amidol, and, after mixing it in the usual way, development is continued in the amidol dish. Of course, the hand-camera worker, especially if he uses f/8 or f/11, will practically require the amidol for his snapshots always. On the other hand, pyro alone will undoubtedly be preferred by the man who uses his camera on a stand and gives time exposures and is accustomed to give "a little extra for the plate."—"Phot.," Oct. 3, 1916, p. 224.

Scum Markings with Tank Development.—A. O. Forrest finds that scum marking around the edges of plates developed in a tank are due to loading the plates into the rack before its grooves are perfectly dry. "B.J.," June 1, 1917, p. 291.

Warming the Developer.—Bruce Young introduces a hot-air chamber upon the developing bench of size about 3 inches high, 12 inches wide, and long enough to accommodate three dishes. The bench is cut below this chamber so as to permit of the circulation of warm air from the combustion of a lamp or gas-burner, the chamber being open at the far end for the escape of the warm draught.

The only obstruction in it is a small damper or piece of bent-up tin near the end C to keep the heat in better. The top of this

chamber is covered with thin sheet metal, as it readily conducts the heat to trays, and is more fireproof. The contents of the three trays (developer rinse, and hypo) are kept at a nice working temperature by regulating the amount of heat from the lamp below. By starting the lamp going a few minutes previous to starting to work, and when the



desired temperature is reached, turning [illegible] low, it will keep the solutions at the desired temperature. — P. F. (from "Bull Phot."). Jan. 26, 1917, p. 50.

Developers Yielding Coloured Images. — Dr. R. Homolka has investigated certain developers which yield an image consisting of metallic silver in loose combination or admixture with a colouring matter. Then by the use of a solvent of the silver, such as Farmer's reducer, an image may be obtained consisting of colouring matter only. One such developer is 4-oxy-iso-carbo-styril of Gabriel and Colman, which by oxidation forms a double molecule, the so-called carbindigo, which is an orange-red substance. This developer has been tried on extra-rapid plates, on lantern plates, and on bromide paper. The developer is made by dissolving at a temperature of about 50 deg. to 60 deg. C., and then filtering, 10 gms. of soda sulphite cryst., 5 gms. of potass. carbonate, 0.5 gm. potassium bromide, and 1 gm. oxy-iso-carbo-styryl in 100 c.c.s of water. In the course of the development a copper-red deposit of separated carbindigo forms a mechanical coating on the film, but is readily removed, after fixing and washing, with a soft brush. Dr. Homolka classifies this new developer with those of the indoxyl, oxy-thio-naphthene and naphthalene series, and applies to all of them the name "indogene" in reference to their production, in association with an image of metallic silver, of an indigoid colour. — "B. J." (from "Phot. Korr."). Feb. 16, 1917, p. 81.

Tests for Developers. — W. Ermen has devised a series of tests by which the developers in use at the present time (1917) can be distinguished from each other. These developers are pyro, hydroquinone, par-amidophenol, Monomet, amidol (diamidophenol), and metol (methyl par-amidophenol).

The first test is to shake up a little of the dry developing substance with a little alcohol. Pyro and hydroquinone quickly dissolve; the other four substances are sparingly or not at all soluble.

The second test is to add a little 10 per cent. sodium sulphite solution to a 1 per cent. solution of the developer. With pyro and hydroquinone there is no apparent result. With Monomet and paramidophenol hydrochloride there is an immediate white precipitate, which dissolves in caustic soda. With metol and amidol there is a crystalline precipitate which slowly forms from a 10 per cent. solution of the developer, but not from a 1 per cent. solution.

The third test is to add a little 10 per cent soda carbonate solution to a 1 per cent. solution of the developer. *Monomet and amidophenol* are precipitated as in test No. 2, but the liquid gradually turns brown. Metol is not precipitated, but the solution turns brown: the precipitates are soluble in caustic soda. *Amidol* gives a *bright blue* solution, which turns green on dilution.

The fourth test is to make a strong solution of the developing substance in dilute sulphuric acid, to cool well, and then to add a few drops of 30 per cent. solution of sodium nitrite. Metol gives a yellowish crystalline precipitate, either at once, if the solution is very strong, or after a few moments if more dilute. No result with the other developers.

The fifth test is to add a few drops of 1 per cent. ferric chloride solution to a 1 per cent. solution of the developer. Hydroquinone gives a yellowish precipitate. Pyro gives a brown colour. Amidophenol gives a chocolate-brown precipitate. Monomet gives a brown solution, turning purple. Metol gives a bright claret colour. Amidol gives a bright claret colour.

The sixth test is to add a few drops of potass bichromate solution to a 1 per cent solution of the substance. Hydroquinone.—No change. Pyro.—Brown, turbid. Amidophenol.—Bluish purple. Monomet.—Brown, turning purple. Metol.—Reddish brown. Amidol.—Brown, turning purple.—"B.J.," July 27, 1917, p. 390.

Fixing, Washing and Drying.

Tests for Hypo.—J. R. Bainbridge has compared the sensitiveness of two methods of testing for the presence of minute traces of hypo. These methods are:—1. Adding a few drops of mercurous nitrate solution and noticing the degree of yellowish colouration (tailing off to a bluish turbidity at greater dilution of hypo) which is produced: and 2. Discharge of the pink colour of a very weak solution of potassium permanganate. He finds that the permanganate test is the more delicate, allowing of detecting the presence of one part of hypo in fifteen million parts of water. The method of making either test is to use two glass cylinders, one containing tap water in which the presence of hypo is suspected, and the other an equal quantity of the uncontaminated tap water. The same quantity of the test solution (mercurous nitrate or permanganate) is

added to each cylinder and any difference noted.—" Phot.." Jan. 30, 1917, p. 81.

Theory and Practice of Washing Out Hypo.—A. Vincent Elsdon, B.Sc., F.I.C., has sought to calculate the quantity of hypo left in the gelatine film of a negative after a certain number of washings in water by means of the Ostwald formula—

$$x_n = x_0 \left(\frac{a}{m+a}\right)^n,$$

where x_0 = quantity of hypo originally present, x_n = quantity of hypo remaining after n washings, n = number of washings, a = volume of liquid remaining on the plate after each washing, and m = volume of water used for each washing.

This formula is considered applicable in all cases where no absorption takes place, and hence may be applied to a photographic plate having only a thin film of gelatine on one side of it.

It will be seen from a consideration of the above equation that the quantity of hypo left in a plate will be the smaller the smaller the fraction $\frac{a}{m+a}$. This fraction will be the smaller the more perfectly the plate is allowed to drain between each washing (for by this means a is diminished), and by making m, the volume of water used for each washing, large as compared with a. The equation also assumes that the period of each washing shall be sufficiently long for a state of equilibrium to be reached between the hypo in the plate and the hypo in the washing liquid—that is, that the concentration of the hypo in the film shall be the same as the concentration of the hypo in the washing liquid.

If one calculates from this equation the quantity of hypo left in a plate after a few washings with a definite volume of water, it will be found that this is so small as to be negligible after a surprisingly small number of washings.

The object of the experiments described below was to determine how closely practice would agree with theory, and it will be seen that, within the limits of experimental error, the washing of plates agrees very well with the above equation, and that plates may be very quickly, and with a very small volume of water, washed so far free from hypo that the quantity remaining cannot be detected by ordinary chemical means.

The method of experiment consisted in thoroughly treating an unexposed plate in a fixing bath containing 4 ozs. of hypo in 20 ozs. of water, following this treatment by a second immersion of the plate for one minute, with gentle rocking in a second fixing bath of the same strength. The plate was then allowed to drain for a definite time and placed in a clean dry dish. A measured volume of water was then poured on to it, and the plate rocked in the dish for a definite time. The plate was then lifted, allowed to drain for a definite time into the dish, and then placed in another clean dry

dish. Each successive washing was carried out in precisely this manner, the volume of the water used and the time of each washing and draining being the same in each experiment. In each case the final washing was for twenty minutes, with frequent rockings of the dish.

Each separate portion of wash water was then transferred to a separate beaker, and the quantity of hypo contained in it determined by means of a standard solution of iodine.

The various tests showed that in treating a plate with water a certain time is necessary in order for the hypo to distribute itself uniformly in the main body of the water and in that contained in the gelatine film itself. This condition of equilibrium is nearly reached in two minutes, but is not quite complete until five minutes' rocking in the dish has been given. There is little advantage, however, in prolonging the time of each soaking beyond two minutes. After the third soaking the quantity of hypo remaining in the plate is too small to be detected by ordinary chemical means. The quantity of hypo removed by each washing was found, in every instance, to correspond very closely with that calculated in the formula. Mr. Elsden concludes:—

1. The rate of removal of hypo from thin gelatine films by washing with water is very closely in accordance with that arrived at on purely theoretical grounds.

2. Absorption effects, in the case of a thin gelatine film, are very small.

3. Plates can be washed for all practical purposes free from hypo by four successive washings of two minutes with comparatively small volumes of water, with intervening draining.—"Phot. Journ.," Feb., 1917, p. 90. "B.J.," March 9, 1917, p. 120.

In a leading article on Mr. Elsden's paper, it is pointed out that the efficiency of washing by means of only four successive soakings each of two minutes is not necessarily realised in the use of one or other of the various "automatic" washers or washing tanks. The reason for this is that many of these pieces of apparatus do not bring the negatives successively under treatment with fresh water—that is, water free from hypo. One of the first essentials in any washer is that the whole of the wash water should drain off before a fresh lot comes into action.

A second point is that no amount of washing, however thorough, will make amends for incomplete fixing. Stains attributed to insufficient washing are seldom really due to incomplete removal of hypo, but arise from incomplete fixing, which leaves in the film certain compounds of silver and hypo which no amount of washing, however prolonged, will remove.

Prints are often imperfectly washed because they are liable to stick together in the water. Free access of the wash water is as important a factor in the washing of prints as complete fixing.—"B.J.," March 9, 1917, p. 119.

Experiments on the same lines have been independently carried out by A. W. Warwick, who has used non-curling film as well as plates, in both cases after development, not unexposed, as in Mr. Elsden's tests. He found that the hypo solution in and on a non-curling film weighs about three and a-half times the weight of the dry film, the hypo therein thus weighing about the same as the film. He finds that Bunsen's formula, as quoted by Ostwald and adopted by Mr. Elsden, does not hold good as it stands, but requires to be multiplied by a factor, e.g., 1.25. It can then serve as a practical guide in the washing of films, plates, and prints. Mr. Warwick gives rules and formulæ for determining the minimum quantity of water which may be used for removing hypo to a given degree from a given quantity of negatives or prints.—"Amer. Phot.," June, 1917, p. 317; "B.J." (containing also a criticism of Elsden's paper), May 18, 1917, p. 261.

Intensification.

Pinholes with Mercury Intensifier.—Various preventives of the formation of pinholes in negatives when intensifying with mercury and ammonia have been recommended. L. I. W. directs that, whilst bleaching, the surface of the film should be rubbed lightly with cotton wool; also the negative, after having been once placed in the ammonia, should not be fingered until dry.—"B.J.," March 23, 1917, p. 155.

F. Vaughan prescribes soaking the plate in methylated spirits for five minutes before intensifying, afterwards rinsing until the water runs off without any sign of grease-like markings.

E. J. M. recommends using a saturated solution of mercury bichloride containing enough acetic acid to make it smell very strongly—*e.g.*, 3 drs. in 20 ozs. The negative, wet or dry, is put in this mixture until bleached right through to the back. It is then well washed and treated as usual in the ammonia bath.—"B.J.," April 20, 1917, p. 210.

R. P. points out that these various recommendations may be embodied in a single process, viz.:—

1. Soak the negative to be intensified in methylated spirit for five minutes, then wash till all greasiness disappears.

2. Bleach in a solution of mercuric chloride to which enough acetic acid has been added to make it smell strongly.

3. Rub the film with a piece of cotton wool while it is bleaching, then wash, and blacken with ammonia, taking care not to rub the blackened film.—"B.J.," April 27, 1917, p. 227.

Antidote to Mercuric Chloride Poisoning.—B. Fantus has recommended an antidote to corrosive sublimate which is more effective than white of egg, the latter being of little value unless given immediately after the poison is swallowed. The antidote consists of sodium hypophosphite mixed with sodium acetate or with hydrogen

peroxide. In cases of poisoning with corrosive sublimate, sodium hypophosphite 15 grains in water and a drachm of hydrogen peroxide should be given. If the amount of poison taken is known, ten times as much hypophosphite should be administered, followed immediately by copious lavage with dilute solution of the antidote. This may be followed by a safe dose of the antidote, which should be retained. Instead of the hypophosphite, a tablet containing 0.36 gm. of sodium phosphite and 0.24 gm. of sodium acetate may be used if it is immediately available. —"B J" (from "Pharm. Journ."), November 24, 1916, p. 643

Reduction.

Non-Ferricyanide Reducer.—C. Welborne Piper finds that the reducer of copper sulphate, salt, and hypo recommended by W. J. Smith in "B J.A.," 1917, p. 358, gives results identical with those produced by Farmer's reducer. The gelatine film acquires a slight blue stain; if this does not disappear in the washing, a dip in a weak bath of sulphuric acid (1 drop of sulphuric acid in an ounce of water) will speedily dispose of it. The formula as given by Mr. Smith is, in fact, too vigorous in its action, according to Mr. Piper, and may well be diluted to half strength in order to bring the action more under control.—"B J.," November 24, 1916, p. 634.

Combined Permanganate Persulphate Reducer.—Kenneth Huse and Adolph H. Nietz, of the Eastman Research Laboratory, have made exact tests of the formula worked out by N. C. Deck ("B.J.A.," 1917, p. 359), and have evolved an improved form of it, the action of which is more nearly "proportionate"—that is to say, reduces the densities of an over developed negative, so that they correspond with those of a plate which had been correctly developed. This improved formula is as follows:—

A.—Potass. permanganate	0.25 gms.	22 grs.
Sulphuric acid, 10% solution	15 c.c.s	130 minims.
Water..	1 000 c.c.s.	20 ozs.
B.—Ammonium persulphate......	25 gms	220 grs.
Water...	1,000 c.c.s.	20 ozs.

To make the reducer, 1 part of A is mixed with 3 parts of B at the time of use. The stock solutions keep well. The time of reduction is from 1 to 3 minutes, but the action may be rendered slower and more controllable by mixing the reducing solution with an equal bulk of water. After reduction, the plate is immediately put for five minutes in a 1 per cent. solution of potassium metabisulphite, and finally washed for a short time.

There is little difference, when using this reducer, between its action upon a wet and a dry negative, except that the wet negative shows a greater tendency to lose fine shadow detail. It is, therefore, best to apply the reducer to the dry negative.

The action of a reducer upon a negative which has been treated in a fixing-hardening bath is little different, but slightly greater and more uniform reduction is obtained if the plates are fixed in plain hypo.

By using the reducer at different temperatures (54, 68, and 83 degs. F.), the degree of reduction is greater with a higher temperature, but the "proportionate nature of the action is not affected."

The greatest differences in the action of the reducer are noticed in respect to different types of plate. The action is most nearly proportionate with plates of emulsion of medium-sized grain, such as the Seed 23. With plates of finer grain, such as the Seed Process, fine shadow detail is more readily attacked.

The developer employed for the negative also has an effect upon the action of the reducer. On a process plate the greatest reduction was obtained on a negative developed with pyro; on a medium plate (Seed 23), on one developed with hydroquinone; and on a high-speed plate (Seed 30), on one developed with ferrous oxalate.—"B.J.," October 27, 1916, p. 580.

T. H. Greenall, as the result of testing the *Deck formula in comparison* with the persulphate and permanganate reducers alone, finds that the mixed formula is not a substitute for persulphate when it is desired to soften gradation; it does not appear to differ in action from permanganate acidified with alum.—"Phot.," Sept. 12, 1916, p. 177.

Persulphate-Hypo Reducer.—T. H. Greenall has worked out a modification of the persulphate reducer, which is found to avoid one great defect of ammonium persulphate used alone, namely, the sluggish action of the solution at first, followed by a sudden period of activity which may lead to over-reduction of the negative. It is found that by adding a considerable proportion of hypo to the persulphate there is apparently no first period of inaction and no sudden activity. The solution remains clear all the time, the process is completely under control, and the reduction may be stopped at exactly the right moment without it being necessary to make an allowance for its continuing further. Moreover, the characteristic action of persulphate upon the gradation of the negative is not affected.

An average formula consists of 15 grs. of persulphate and 15 grs. of hypo in 1 oz. of water. This is best made up by dissolving the persulphate at the time of use, and adding the hypo (to the requisite amount) from a stock solution. Hypo may be added up to four times the amount of the persulphate, reduction then taking place more rapidly. The time of reduction is also shortened by increasing the quantities of both persulphate and hypo.—"Phot.," Mar. 21, 1917, p. 205.

Potassium Persulphate Reducer.—C. Welborne Piper, in the course of other experiments made for the purpose of comparing the effect of substituting ammonium hyposulphite for ordinary hypo in

the Farmer reducer, has found that potassium persulphate is a much more reliable reducer than ammonium persulphate, probably for the reason that it is not deliquescent. It is bought as a very fine powder, which is somewhat difficult to dissolve, and is best dealt with by grinding it under water in a mortar. Although costing about a third more than ammonium persulphate, it is more economical. A little acid (*e.g.*, 1 drop strong sulphuric acid per 20 ozs.) appears to be necessary in order to cause reduction to start in a reasonable time, say, one or two minutes; but once the solution has begun to work, it can be used over and over again until exhausted. A solution of 1 per cent. strength (90 grains in 20 ozs) is strong enough for general use.—"B.J.," November 24, 1916, p. 634.

Hypochlorite Reducer.—W. E. Debenham, writing as the introducer of this reducer, in regard to an editorial reference to it, mentions certain precautions necessary for its successful use. Rocking the dish in which the negative is immersed, there will after a minute or two be noticed a running off of a fine black deposit, as if the image was formed of Indian ink. If the plate is lifted out of the solution for examination before sufficient reduction has taken place, it must be quickly returned to the dish, or marks may result where the liquid runs away in greasy-looking patches. When it is judged that the intensity is sufficiently reduced (allowing for a slight continuation of the reducing action in the first washing), the plate should be plunged into a dish or bowl, and moved quickly up and down until the solution is removed by the washing; and until, when the plate is lifted out and held vertically, there are no lines or patches formed by uneven running off of the water.

The plate should not, in the first instance, or, indeed, not at all, unless with constant to and fro motion, be held under the tap, as where the stream of water falls with pressure on the film, thin places will result. This property, indeed, may, as mentioned by Messrs. H. P. and Ralph Robinson, be utilised for effecting greater local reduction on any desired portion of the negative. The plate, when water runs off quite evenly, may now receive a little additional washing before being stood up to dry.

I never made any exact measurement of the action of the hypochlorite solution on the different degrees of intensity of the image, but so far as could be judged by inspection, the action was quite regular, without any undue weakening of the fainter half-tones. Another, though less important, advantage, is that there is no change of colour of the image or of the film, either in the lights or the shadows.

A disadvantage of the process was that with some plates there was a tendency for patches of the film to separate into skins or thin layers, and if a patch does so come away, not only is the image left rather weaker in the thinner place, but the edge of the unremoved portion of the film will show a light line. Reticulation, properly so-called, I have not observed.

The reason that this disadvantage did not show itself in the early

days of my experience may be that at times I used plates of my own manufacture, and I put chrome alum into the emulsion, not finding it to slow the plate as stated by some writers. In studios in which I have quite recently introduced the hypochlorite reducer, I have also not seen any of this separation into skins, and it may be that modern commercial plates also contain a hardening ingredient.

Formulæ that I have seen published for the preparation of Labaraque's solution seem to me very unsatisfactory, as they specify the direct mixture of some given weights of chloride of lime and of carbonate of soda (washing soda). As "chloride of lime," especially when not quite fresh, is of ill-defined composition, the resulting solution must be varying also, and may contain a considerable proportion of caustic soda in proportion to that of the active hypochlorite reducing the photographic image. The method that I adopted, and that, I think, but am not quite sure, I published in one of the photographic papers or "Almanacs," was to put a pound of commercial chloride of lime, as fresh as could be obtained, into a Winchester quart bottle and fill up with water. After a good shaking, and standing a little time to settle, the solution is filtered, and to the filtrate a sufficient quantity of washing soda in strong solution is added to precipitate the lime as a carbonate. The solution is then filtered, and diluted when required for use with from four to six parts of water.—B.J., Sept. 1, 1916, p. 487.

"G. M. R. M." gives the following working details for the use of this reducer, which he has had in regular practice for many years :—

Frilling will never appear if the temperature of the baths is not higher than 66 deg. F. (60 deg. F. is the best temperature).

I generally use a plain 2 per cent. solution of hypochlorite of soda and pour it upon the negative, gently rocking for a few seconds. Then I take a tuft of pure cotton of a size according to the size of the negative, say of an egg for a half plate, dip it in the dish, and press it in order to rub a dense portion of the negative with a small surface of the cotton.

As soon as you see the portion of the cotton becoming grey, it is a sign that the dissolving action of the hypochlorite upon the gelatine has begun. Then take the negative out of the dish, and, holding it as you find it best, rub it with the tuft of cotton generously impregnated with the solution in order to assure its soft action on the negative. Do that a few times from top to bottom, from right to left, and circularly. About every five or ten seconds see on your cotton the amount of reduced silver dissolved; if it looks decidedly grey, put the negative under the tap and examine it. Wash also your tuft of cotton until it becomes quite white, dip it in the solution, and rub again evenly or partly, as you like, washing again and rubbing until you have obtained the desired result. Then wash a few seconds under the tap, and put the negative in :

Water	1.000 c.c.s.	20 ozs.
Pure hydrochloric acid............	3 c.c.s.	25 minims.

This solution immediately stops the reducing power of hypochlorite,

and the reaction produced cleans the film perfectly. After three to five minutes, wash for half an hour and dry. You will have then a negative where all the gradations have been preserved, and which allows the treatment of pencil and knife as well as on a non-reduced one. Thi invaluable fact cannot be obtained, I think, by any other reducers, as generally the film is glossy and hard.

The only disadvantage of the method is that it is difficult to reduce slightly a second time a negative already treated. When this is done, unless the silver dissolves evenly, there is a very thin film, which goes out unevenly something like a skin. In rubbing a little more, all this skin can be removed but sometimes the negative is then seriously lighter. A negative that has already been reduced can easily be recognised by breathing upon the film and then smelling it: a very special odour is produced.

A point which also needs attention is the strength of the reducing solution. It must not work too quickly nor too slow to be well under control, and this greatly depends on the brand of plates, on the developer, and on fixing bath containing alum or not

According to the case, the percentage must be slightly modified and a test made with each new bottle of hypochlorite, as this chemical is not always of same strength, even when coming from the same firm.

Hypochlorite is as easy to use as any other reducer, and its many advantages, its cheapness, its preservation are worth a trial. "B. J.," September 15, 1916, p. 519

W. E. Debenham writes in reference to the above to point out that the two methods, rubbing away and immersion, have each their own advantages according to the effect which it is desired to produce. The rubbing method is to be preferred if it is desired to reduce locally some portion of the negative, whilst the immersion plan ensures more regularity of action if the original ratio of density is to be preserved all over the plate after reduction. A combination of the two methods is sometimes useful The parts to be most acted on may be rubbed until nearly reduced enough and then the plate immersed in a somewhat stronger solution to act on the whole of the image. An advantage of the rubbing plan is that a weaker solution may be employed, and consequently in unaccustomed hands there is less danger of too great reduction. Should this take place, however, the image is easily intensified by the iodide of mercury intensifier.

Those not accustomed to chemical manipulations may find some difficulty in determining the amount of washing soda to be used for the precipitation of the lime (as described in the paragraph already printed, appearing on page 304). A little excess will do no harm; a quarter of a pound of soda dissolved in eight ounces of water may be used for the quantity of chloride of lime solution mentioned. If the soda solution is filtered before adding to the lime solution the resulting precipitate may be washed on the filter paper after all the solution has gone through, and when dry is such a very fine and soft powder that it may be used even for polishing lenses.

Plates are now made so hard that a stronger solution than that

mentioned may be desirable for the immersion method. This can easily be ascertained by trial on one or two waste negatives -- "B. J.," September 29, 1916, p. 538.

The Hypochlorite Reducer.--Kenneth Huse and Adolph H. Nietz, of the Eastman Research Laboratory, have made tests of the hypochlorite reducer introduced by W. E. Debenham, as regards the extent to which it exerts a proportionate action. They tested a solution consisting of 15 grammes sodium carbonate and 21 grammes calcium hypochlorite in 1,000 c.c.s. of water. The negatives were dried and were soaked for half an hour before applying the reducer. After reduction they were rinsed and bathed in a weak solution 2 to .3 per cent. of hydrochloric acid. It was found that the reducer exerted a highly proportional action very similar to that of the persulphate permanganate formula of Deck, although its action was somewhat more vigorous on the lower densities. It is, therefore, a reducer which has the effect of lowering contrast and thereby correcting over-development. "B. J.," March 16, 1917, p. 143.

Retouching.

System in Retouching for the Trade.--An anonymous writer has described at length the system adopted by him in carrying on an extensive business of retouching photographers' negatives. As a basis for charging it was found best to adopt the length of the head, measuring from the roots of the hair to the base of the chin. Work is thus classed into divisions such as the following:--

Grade.	Negatives Features Measuring up to and Including						
First class	½ in.	[illegible]	[illegible]	1¼ in.	[illegible]	2 in.	2½ in.
Second class	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 in.	[illegible]
Third class	[illegible]	[illegible]	[illegible]	1½ in.	[illegible]	2 in.	3½ in.

[illegible]

Prices are fixed according to the grade of work, such prices including ordinary slight knife work and varnishing. Extra charge is made for negatives of ladies in evening dress, low necked blouses, or draped busts; as also for blocking out or special amounts of knife work.

Negatives being thus classified it is possible for the trade retoucher to arrange his work so that in doing a batch of negatives (in, say, second quality) he can work out in advance the time he can afford to spend on each, and thus secure uniformity of work over the batch.

As regards "systematic remuneration," we must first decide for ourselves how much our *time* is worth. Broadly speaking, considering the nature of the work, the opinion may be expressed that a remuneration which work out at eighteenpence per hour is fair, but certainly not overpaid. It is assumed that the worker is above the average, and it must be realised that he is not employed full time by one employer; frequently some hours, or even a day or two, may go to waste owing to the want of negatives or a delay in the postal delivery. Again, occasional rushes may occur, which very often

necessitate sitting at the desk far into the small hours of the morning.

To illustrate this system, then, we must calculate our value per hour, measurement of the features, quality of work required, and the amount we are to charge per inch for first, second, and third-class finishing. Assuming that we value our time, say, at sixteenpence per hour, the features measure 1 in., the qualities required for each of three 1-in. heads are first, second, and third, and our charges for each of these are respectively eightpence, sixpence, and fourpence, we should retouch per hour two negatives at eight, just over two and a-half at six, and four at fourpence. Consequently, the quality of the work, which is almost automatically regulated, assures the retoucher equality of payment for his time and, in addition, a very fair distribution of *proportionate* labour over negatives bearing *different* prices.

It has been admitted that certain negatives may require extra work, but in practice they have not been found numerous, especially in the better-class work. Instances have occurred where the requisite finish has been obtained under time, and further effect might have proved detrimental; thus, as a general rule, it will be found that the gain will balance the loss.—"B.J.," September 14, 1917, p. 472.

Film Photography.

Negatives on Flexible Supports.

Renovating Film.—A. P. H. Trivelli has patented the following preparations for the renovation of scratched (cinematograph) film on one or both faces, the solutions consisting of hard-drying varnish or lacquer which fills up the scratches.

I.—Methyl alcohol	25 to 35	parts.
Ethyl alcohol	67 to 57	,,
Pyroxylin	2 to 3	,,
Drying oil*	5 to 4	,,
Salts of abietic acid	1	part.
II.—Benzole	95 to 90	,,
Drying oil*	5 to 10	,,
III.—Ethyl alcohol	5 to 60	,,
Methyl valerianate	45 to 35	,,
Drying oil*	5	parts.

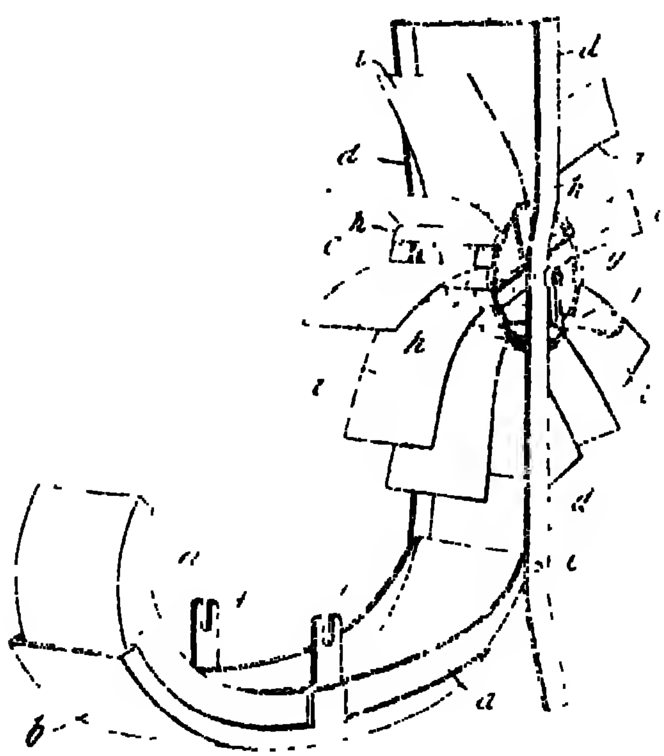
* *i.e.*, Boiled vegetable oils.

If for use in a moist and hot climate, such treated films may be given a very thin coating of grease in order to prevent their sticking together.—Eng. Pat. No. 7956, 1915. "B.J.," Nov. 3, 1916, p. 600.

Stripping Film.—E. A. Pim has patented the use of a substratum of soap between an emulsion and a temporary support for the purpose of stripping off the finished negative film. The temporary support may be of paper. The solution for the soap substratum may be prepared as follows:—Gelatine, 1,000 gms., is soaked in 8,000 gms. cold water and then heated on a water bath

to about 80 deg. C. When the gelatine has dissolved, addition is made of 20 gms. of 6 per cent. chrome alum and 200 gms. water. The mixture is kept in a fluid state for about half an hour, and then there is stirred into it, first, a solution of 166 gms. soap in 300 gms. water, and then 100 c.c.s. glycerine at 28 deg. C. This mixture is applied to paper by ordinary emulsion-coating machinery, and the paper dried. Thus prepared, the film of gelatine, soap, etc., adheres to it, but is readily detachable. Paper thus coated is then used as the support of the gelatine emulsion.—Eng. Pat. No. 102065. "B.J.," Dec. 22, 1916, p. 692

Machine Development of Cut Films.—J. C. Munro has patented a machine for the development of cut films such as the Eastman Portrait film. It consists of a trough, *a*, holding the developer which can be brought to any required temperature by pouring



water into a lower trough *b*. The films are held in grippers placed around the rim of a wheel which latter is provided with a handle, *j*, and is mounted on a hinged frame, *d*, so that the wheel can be brought down close over the developer in the tank, *a*, and the films drawn in succession through the solution by turning the handle, *j*. By this arrangement the progress of development can be watched when a given film is projecting from the upper surface of the wheel. The apparatus serves also for the development of prints and post-cards.—Eng. Pat. No. 102645. "B.J.," Jan. 19, 1917, p. 35.

V.—PRINTING PROCESSES.

Holding Back Parts of Negatives.—E. Hage recommends, as an effective means of strengthening shadow portions of negatives in printing, the dabbing of the glass side of the negative with Plasticene—preferably the dark red kind. The Plasticene can be easily moulded to a crayon-like point, and can be easily applied to the glass in greater or less density, and as easily removed when required.—"B.J.," Dec. 1, 1916, p. 651.

Print-out Papers.

Phosphate Emulsion.—The lapsed patent taken out by York Schwartz, No. 9855, 1907, has been restored to the patentee by an order of date May 11, 1917. The patent relates to the making of a silver phosphate emulsion, the developer for which is a simple solution of metol. It is understood that this process is the basis of the paper placed upon the market at the end of 1908 as "Ensyna."—"B.J.," May 25, 1917, p. 277.

Palladium Toning Bath.—E. Valenta has found that a palladium toning bath containing ammonium chloride, sodium glycolate, and succinic acid forms a toning solution which yields fine black prints, and with suitable proportions may be used in conjunction with a hypo fixing bath. The procedure recommended is as follows:—The prints (on collodio-chloride paper) require to be darkly printed, are well washed, and then toned in—Sodium acetate, fused, 10 gms.; borax, 10 gms.; gold chloride (1 per cent. solution), 40 to 50 c.c.s.; water, 1,000 c.c.s. Here they are kept in movement until they have assumed an even reddish tone. They are then rinsed in water and toned in the palladium bath, viz.:—

Potassium chloro-palladinite	1 gm.	9 grs.
Ammonium chloride	50 to 100 gms.	1 to 2 oz
Sodium glycolate	10 gms.	90 grs.
Succinic acid	4 gms.	35 grs.
Water	1000 c.c.s.	20 ozs.

Prints are toned in this bath until they show an even black colour, with a shade of violet in it, in the shadows. They are then passed through a bath of weak ammonia and fixed in 10 per cent. hypo.

Used without previous gold-toning, the palladium bath yields fine brown to brownish black tones. Its toning action is rapid; if the bath is found to tone too slowly, the proportion of ammonium chloride should be reduced. In conjunction with the gold bath the palladium formula yields the fine black tones characteristic of the gold and platinum baths used in succession.—"B.J." (from "Phot. Korr."), Feb 16, 1917, p 80.

Ferrocyanide as Desensitiser.—In reference to the alleged invention of a solution of ferrocyanide as a means of desensitising (fixing) P.O.P. prints (see "B.J.A.," 1916, p 460), Dr. J. M. Eder calls the German "inventor," Herr Sulzberger, to account for omitting to note that the process was suggested many years ago by Fox Talbot and Robert Hunt, and is duly chronicled in Eder's "History of Photography." Dr. Eder is indignant that a patent should have been granted in 1915 in respect to something which was discovered by Fox Talbot in 1839.—"B.J." (from "Phot. Korr."), Feb. 16, 1917, p. 81.

Bromide and Gaslight Papers.

Rapid Printing and Vignetting Boxes.—W. Marshall has designed several labour-saving appliances in the shape of—(1) a printing box for vignetting and masking, as in the production of sketch portraits; (2) a box for printing from film negatives for the production of prints with white borders without cutting up the band of film; and (3) a box for the daylight printing of gaslight paper.

In the first two of these a special form of electric switch (Fig. 1) is used, the good features of which are its substantial construction, the readiness with which it can be attached outside any printing-box, and, further, the fact that its construction allows of extra firm pressure of the paper against the negative being given after the white printing lights have been switched on. Essentially the switch (Fig. 1) consists of a central brass rod (A) fitted with a brass collar (B). The rod is guided in an aperture in a piece (C) projecting from a stout brass plate, screwed, as shown in the drawing, to a larger piece of vulcanised fibre, through the screw holes in which (also shown) it is fixed to the outside of the printing box. The other guide-hole is one in a block of ebonite or other insulator (D), also screwed to the supporting brass plate. A strong spring below the collar and a somewhat weaker one above it (each securely attached to the collar itself) keep the brass rod normally in the raised position with the collar in contact with a strip (F) of brass screwed to the ebonite block (D), and in turn connected by an inch or so of flex to the left-hand terminal. When pushed down by the arm of the pressure-board the lower spring of the rod is compressed, and the collar then engages with the shorter brass strip (F), likewise screwed to the ebonite base and connected to the right-hand terminal. A short length of flex from the end of the moving rod to the central terminal completes the switch.

The diagram (Fig. 2) shows the wiring in the fitting of a red lamp and one or more white lamps to be operated by this switch. It is

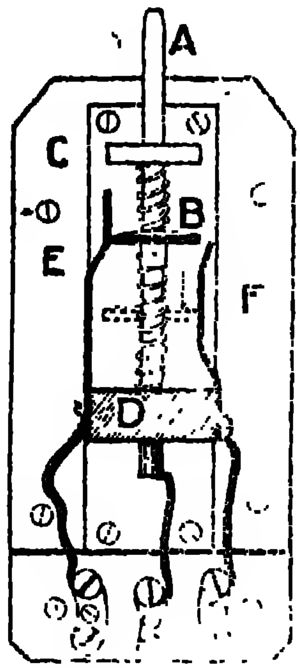


Fig. 1.—Printing Box Switch.
A. Brass rod, fitted with brass collar B, guided by projecting pieces, C, brass, and D, of ebonite, E and F, brass springs.

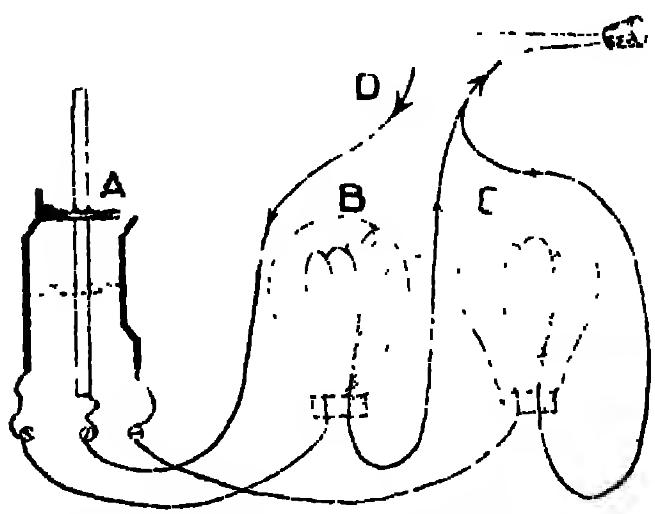


Fig. 2.—Wiring of Switch (fig. 1) to Lamps in Printing-Box.
A, Switch, B, red lamp; C, white lamp; D, flex from switch-rod A direct to adapter.

assumed that current is taken from the main supply by means of one of the most convenient "adapters," which can be fitted into

any lamp-holder, and thus allow of a printing-box being instantly put into action or replaced by another, and calling for only one electric connection in the near neighbourhood of several such boxes.

Rapid Printing, Vignetting, and Masking-box.

The box for vignetting and masking measures about 14 in. (height, width and depth), and is fitted with the switch described above and shown diagrammatically as A in the drawing (Fig. 3). Four metallic-filament lamps (for white light) are arranged on the floor of the box, together with a fifth lamp for red light. To the upper side of the box (the open top) is fitted a sheet of ground glass, B, the vertical distance of the ground glass above the level of the tips of the lamps being 3½ in. On the ground glass is laid a movable piece consisting of a 12 by 10 board, C, provided with two end cross-

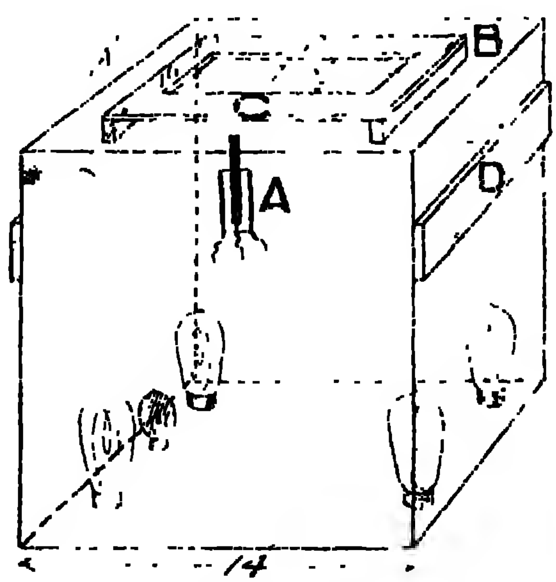


Fig. 3.—Vignetting and Masking Printing Box.
A, Switch; B, ground glass; C, board, supporting vignetting strips

pieces on its underside, raising it one inch above the ground glass. For half-plate work a central aperture 7 by 5 in. is cut in this vignetting board.

The vignetting mask is built up at the time of use by laying a sufficient number of lengths of serrated card, averaging in length about 5 or 6 in. (some shorter pieces) upon the vignetting board so as to cut down the 7 by 5 aperture to one of the required size and serrated outline. When this has been done satisfactorily, as found by viewing the negative, fixed in the top piece to be next described, a sheet of tissue paper is laid over the arrangement of vignetter strips and the apparatus is ready for use.

The top piece (Fig. 4) consists of three parts:—A, a stout frame fitting over the top of the box (Fig. 3) and supported thereon by outside strips, D, attached to the back and each side of the box: a carrier frame, B, for the negative, consisting also of a stout

frame, making a light-tight closure on the frame A, and provided with a glass plate to support it; and C, the pressure back, which in turn is hinged to B and has a projecting handle, D, which, when the back is brought down, presses down the spring of the switch A in Fig. 3 and effects the exposure. The depth of frames A and B is so chosen that the negative is about 2¼ in. above the ground glass of the box (Fig. 3). The chief part of this depth requires to be obtained by means of the frame A in order to leave room for the thickness of the vignetting board, but in the construction of the

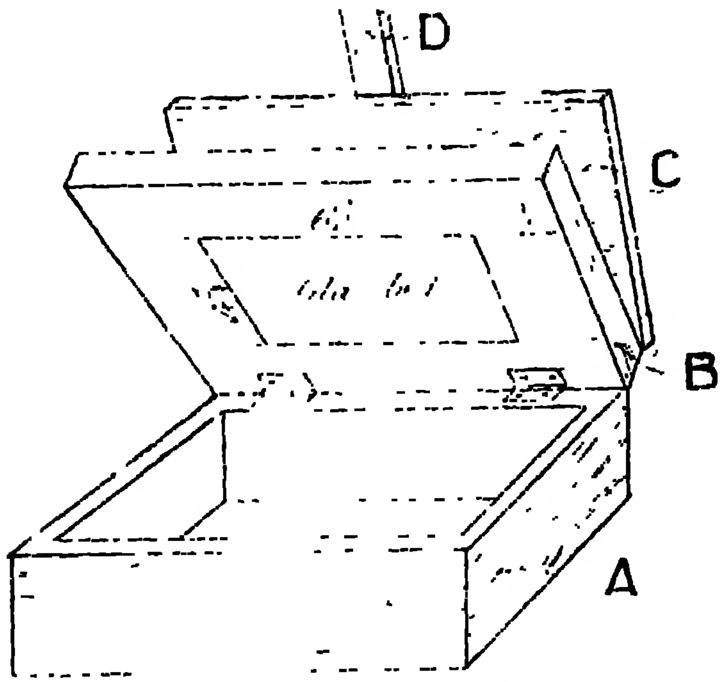


Fig 4. Top piece for Vignetting-Box (Fig. 3).
A, frame; B, hinged frame fitted with glass, and forming negative bed;
C and D, pressure back and lever.

appara[illegible] there is latitude for the use of wood of different thicknesses [illegible]nces already mentioned (of the vignetting board and of the negative above the ground glass) are obtained.

The printer allows also of the accurate placing of a mask upon the negative, the recessed space in which the negative is laid serving to keep a thin paper mask exactly in position. It is a matter of only a minute or two's work to arrange the vignetting pieces upon the vignetting board, bringing down the frame B with the negative in position in order to judge exactly what degree of vignetting will be obtained.

Rapid Film Printing Box.

With this box a set of masks, corresponding with film negatives from spools of all sizes, is used for the purpose of printing the pictures with a white margin. The box allows of the smaller sizes of film negatives being printed two-on or four-on, thus saving much time in the handling (washing and drying) of the prints.

The printer (Fig. 5) consists of a box measuring about 12 by 12 by 12 ins., with ground glass fitted flush with the top and with the

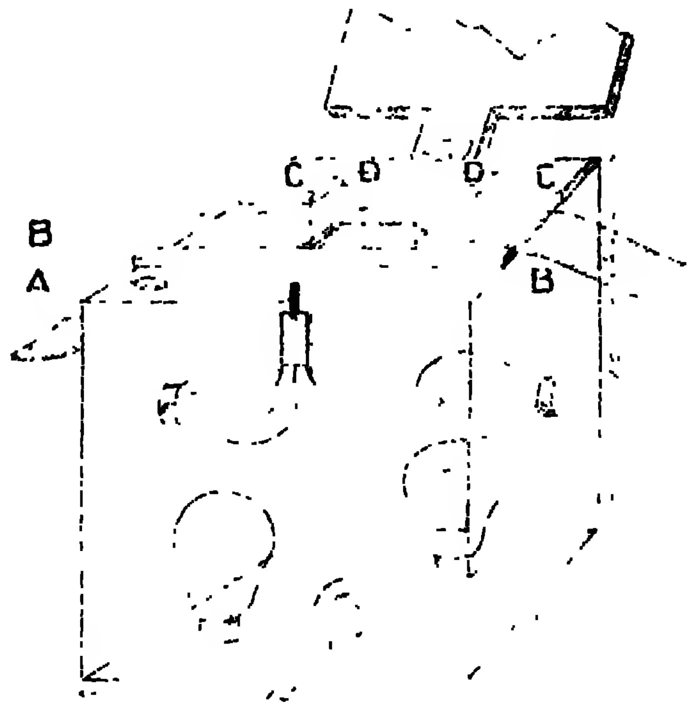


Fig. 5.—Film Printing Box for Mask and Film.
A, Sight hole; B, guide strip; C C, back guide piece with recess D D.

switch, already described, screwed to the front. The wiring is arranged for two lamps on the floor of the box, for printing on bromide paper as well as for two others about 5 ins. below the ground glass for use in printing on gaslight paper. In addition there is, of course, the red light for placing the negative in position.

The novel part of the apparatus consists in the top, which preferably is made as a separate piece, which can be pushed over the top of the box or can be hinged to it. It consists of a frame fitted first with a small sight hole, A, covered inside with orange-coloured film, and serving as an indicator of the switching on of the white lights. The main portion of the frame is fitted with clear glass to serve as the support for the band of film negatives. About an inch or so from the front a narrow strip of wood about ¼ in. thick, BB, is screwed parallel with the front edge. To the rear part of the frame a second board, CC, is fitted, to which is also hinged the pressure back. It is of about ½ in. thickness, and is cut out to form a recess shown at DD. The space between the inside edges of BB and CC is just over 5½ ins.; that is, sufficient for roll film of the greatest width.

The film band to be printed is laid on the top of the printer, with one edge against the inner side of BB. Below [illegible] first placed [illegible]

mask of the special shape shown in Fig. 6. The outline of this mask corresponds in size and shape with the space between the

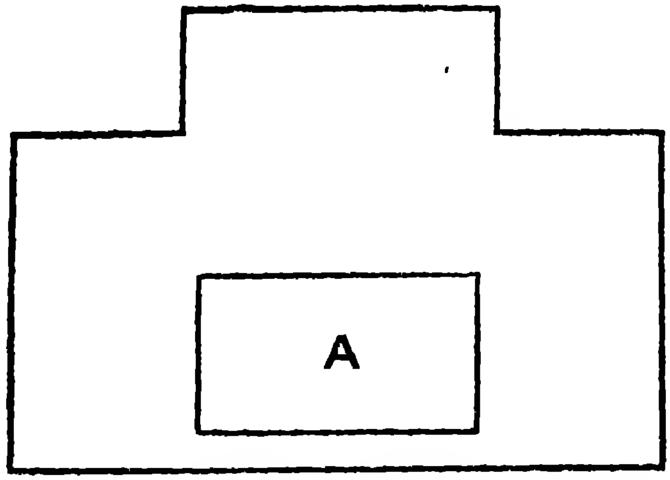


Fig. 6.—Paper Mask for Film Printing Box (fig. 5).
A, Aperture, size of picture from film negative. Mask is laid between B B and C C (fig. 5).

slops, BB and CC, including the recessed space DD. The mask, in other words, just fits the open printing space on the top of the box. A series of masks of this shape are provided, each with an aperture, A, cut in it of size and shape suitable for one or other of the standard pictures taken in roll film cameras. It will thus be seen that the operation of printing consists simply in moving the film band along, so that each picture in turn is visible in the aperture of the mask, laying on the paper and making an exposure with the pressure back. The film band is held in position by one finger from one side or another as the printing of the six or twelve is done. A further economy of time is effected, as already stated, not only in printing, but more particularly in developing and washing by using printing paper of size to take two or four pictures. In this case it is simply necessary to move on the negative one picture and make a successive exposure in another place on the same piece of paper. The mask automatically protects all parts of the paper other than that which is being printed from the negative.

Daylight Printing Box for Gaslight Papers.

This box is for use where diffused daylight is available for printing, the box being made so that it is operated entirely inside a room in the wall of which an aperture is made to admit light. In Fig. 7, showing its construction, it is assumed that the observer is standing facing the wall against which the printer is fitted. The apparatus consists of a box of, say, 12 by 12 by 12 ins., the open top of which is fitted with a sheet of ground glass, BBBB, and can have placed on it any convenient pattern of combined frame and pressure back, such as that shown in Fig. 4. Within the box is fitted a curved reflector of white card, C, placed from corner to corner,

and serving to reflect upwards through the negative the light which enters the box in a horizontal direction.

A very simple and efficient device is adopted for making exposures. On the face of the box which comes against the wall is fitted a pair of upright channels within which slides up and down a frame divided into two parts. The lower part, D, has a small ruby window about 6 ins. square, whilst the upper part, E, is left

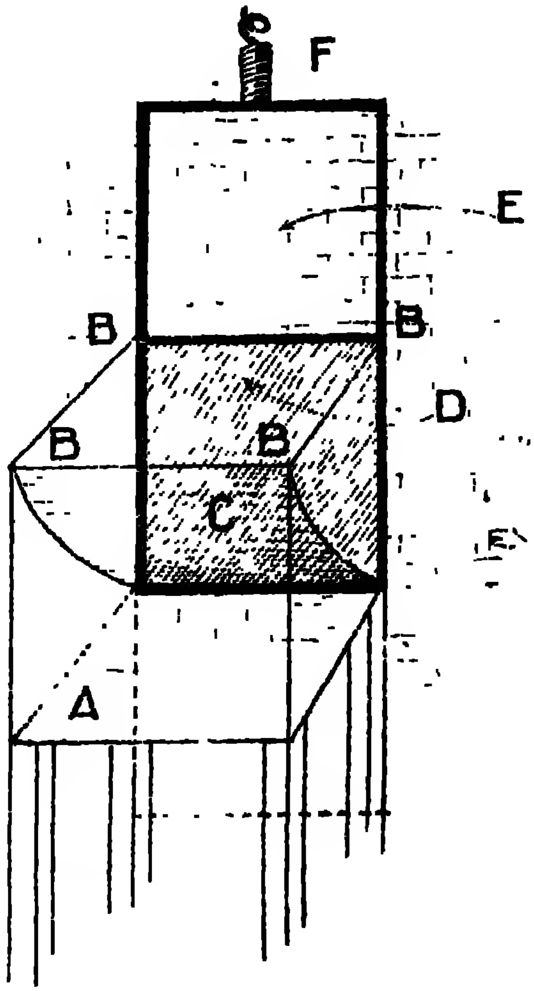


Fig. 7.—Daylight Printing Box for Gaslight Papers.
A, Box, carrying top piece such as fig 4. B B B B, ground glass; C, white card reflector; D E, frame, moving up and down: D, with ruby window, E, clear; F, spring, bringing frame to up position.

open. To the top edge of the frame is fixed a coiled spring, F. The drawing shows the position of this moveable frame when placing the paper in position on the negative. For the sake of clearness the detachable frame carrying the pressure back is not shown. On the pressure back being put down, all that is necessary is to press the frame down quickly, depressing the ruby screen and bringing the clear part opposite the reflector, C. On releasing the spring,

the frame moves up again, and the front of the printer (that is, the side next to the wall) is closed again by the ruby screen. Where an even light is available, as from a north aspect or where the room in which the printer is fitted is shut in by surrounding buildings, a daylight printer for slow gaslight work is a very convenient appliance, particularly in enabling the photographer to deal quickly with negatives of heavy density. The open space in the wall should be fitted outside with a door which can be closed and secured with a catch when the printer is not in use.—"B.J.," March 30, 1917, p. 161.

Positives Direct on Bromide Paper.—For processes applicable to the thinly coated bromide paper used in Photostat and similar copying machines for producing a positive copy by chemical reversal, see under this heading under "Copying," Section III.

Machine Development of Prints.—See "Machine Development of Cut Films," under "Film Photography," Section IV.

Sepia Tones by Direct Development.—A. Nietz and K. Huse, in a paper from the Eastman Research Laboratory, have detailed the precautions necessary for obtaining really good sepia tones directly by development. The only paper found really satisfactory was "Artura." The best developer was chlorhydroquinone.—"B.J., September 28, 1917, p. 497.

Improving Tone by Re-Development.—David Ireland, as the result of a series of tests of different formulæ, recommends the following as the most satisfactory means of producing bromides which are an improvement on the results of development not only in colour but in scale of gradation. All the processes can be carried out in full artificial or daylight.

For a cold engraving black tone the bromide is bleached in a solution containing:—Copper sulphate, 1 oz.; sodium chloride, ¼ oz.; sulphuric acid, 20 minims; water 12 oz. This bleaches the image to a pale brown; the solution is poured away and the print washed for five mins.—not longer. The bleaching solution should never be used a second time.

For re-development only one developer gives certain results, namely, acid amidol. This is prepared at the time of using by dissolving a teaspoonful of sodium sulphite in 3 oz. of water, adding a small saltspoonful of amidol and about 30 minims of sodium bisulphite lye. This latter can be made by pouring 6 drams of sulphuric acid into 10 oz. of water, adding 5 oz. soda sulphite cryst., and shaking until it dissolves. After re-development it is best to pass the print for a couple of minutes through the ordinary hypo bath, afterwards well washing.

For a warm black tone, the print is bleached in a solution consisting of a teasponful of common salt dissolved in a couple of ounces of water, to which is added one dram of sulphuric acid, and sufficient of a strong solution of potass permanganate

to give it a rich crimson colour. As bleaching proceeds, the solution loses colour, and further small additions of permanganate are made until the image has entirely vanished. If sufficient salt and sulphuric acid are used, there will be no staining, and a wash for a minute or two will leave the print pure white and ready for redeveloping.

The same developer, acid amidol, is employed, but development will be rather slow unless the dish is carried out of doors and held under the sky, when it will be complete in about one minute if the daylight is good.

When the nature of the subject calls for a less intense colour than black, a rich dark sepia is obtained by the application of ammonium sulphide thirty minims to two ounces water after the use of this bleacher.—"A.P.," Nov. 20, 1916, p. 403.

Economy in Ferrotype Sheets.—A. E. Edwards finds it a good plan, as regards prolonging the working life of ferrotype glazing sheets, to mount each sheet on a board which provides an inch of margin all round the ferrotype. The board is provided with a ring at one end, by which it can be hung up on the wall while the prints are drying, while at each corner, on the same side as the ferrotype is placed, a brass-headed [illegible]. These nails allow the boards to be stacked up together [illegible] anything being in contact with the surface of the ferrotype itself, which might scratch it.—"Phot.," Dec. 12, 1916, p. [illegible]

Toning Bromide and Gaslight Prints.

SULPHIDE TONING.

Range of Tones in Sulphide Toning.—[illegible] recommends as a very satisfactory means of obtaining a range of tones from light brown to deep chocolate and sepia, a modification of the ordinary process of bleaching and sulphiding consisting in the brief treatment of the bleached print with a developer before sulphiding, as already suggested in "B.J.A.," 1917, p. 381.

The prints are bleached in the usual way and are washed in several quick changes of water. They are then immersed in a well-diluted solution of developer for about 40-60 seconds. They are again washed, and are then placed into a slightly diluted or old sulphide solution. They are taken out when toning is well on the way, or when it appears to be completing (see below) and placed direct into the developer.

On no account must they be left in the sulphide solution till toning is complete, as if this is done no further change takes place in the developer.

They are allowed to remain in the developer for two or three minutes, at the end of which time a pleasing brown tone will result (see below). They may be again rinsed, placed in the sulphide solution for a minute or two, and washed for half an hour,

or they may be placed direct from the developer into running water and allowed to wash for the same period.

A fine range of tones, from light browns to deep chocolates and sepias (according to (a) the depth of printing and (b) the stage at which the prints were taken out of the first sulphide bath), are obtainable by this process. A deep cream-crayon print, especially one with heavy foliage, will yield an exquisite and almost two-colour effect. This process has many advantages, as it is both economical and quick, and the results obtained will more than repay any extra trouble taken by the worker. In conclusion, a cautionary note may be needed. It is important that no developer be carried into the sulphide solution, but it does not matter if the sulphide is carried into the developer.—"Harrington's Photo. Journ., Sept. 20, 1916, p 304. "B.J.," Nov. 17, 1916, p. 626.

Blisters in Sulphide Toning.—J. W. Sugden states that the addition of one or two drops of acetic acid to the sulphide bath is a complete preventive of blisters on prints when toning them by the sulphide method Prints sulphided with this addition to the bath have shown no signs of fading within eight years.—"Phot.," Dec. 12, 1916, p. 390

Single-solution Non-acid Permanganate Bleach.—T H. Greenall has further improved the permanganate bleaching solution originally introduced by him ("B.J.A.," 1914. p. 655, and 1917, p. 378) for sulphide toning in place of the customary mixture of ferricyanide and bromide. At a demonstration before the Chorley Photographic Society he showed that by omitting the acid from the formula and by using a considerable proportion of salt, a bleacher is obtained which keeps perfectly in condition ready for use. and may be used over and over again. The formula is as follows:—

Stock solution of potass permanganate, 2 grs in 1 oz	4 to 5 ozs.
Common salt (sodium chloride)	1 oz.
Water to make	20 ozs

Half an ounce of powdered alum may be added; it makes a quicker bleach, but is not necessary Ordinary powdered lump salt should be used, not fancy table salts, which contain potato starch and are unsuitable. Twenty ounces of the bleach suffice for about 50 postcards.

The prints do not bleach out as in acid permanganate, but the image changes from black to dingy brown grey, and as soon as the deepest shadows are seen to be affected by the solution the bleaching may be regarded as sufficient. With fresh solution the time varies with the character of the print from two to five minutes. Short bleaching is the best for weak prints lacking in depth in the shadows. Longer bleaching gives the warmest tone, but after the shadows are distinctly veiled over, doubling the time in the bleacher makes little if any appreciable difference in the final result.

With acid permanganate it is customary to sulphide the prints

direct as taken from the bleacher, and clear afterwards, but with the non-acid solution we must reverse the process, and clear before sulphiding. The clearing bath must not be too strong, nor contain excess of sulphite, nor acid sulphate, and as there is a possibility of some continuing action it is well to use hydrochloric acid, or salt in all cases. The following is perfectly satisfactory. Make two stock solutions:—

A.	Hydrochloric acid, diluted (1 in 5)	..	2 ozs. fl.
	Common salt (10 per cent. sol.)	....	1 oz. fl.
	Water to make	....	20 ozs.
B.	Soda sulphite	... ..	1 oz.
	Water	.. ..	20 ozs

To make the working clearing bath add at time of use 20 or 30 minims of B. to 20 ozs. of A. The clearing solution may be used until it gets too slow, and must then be thrown away—*not strengthened.* Clearing takes about half to one minute, but five minutes have not been found injurious

In dealing with many prints the simplest procedure appears to be to have three dishes, the first containing water in which the prints are to be rinsed on taking them from the bleacher; the second, clearing solution in which the prints must remain until perfectly white back and front, with more or less of grey image remaining; and the third, water in which the cleared prints may remain until a convenient time for sulphiding. Before sulphiding, the prints should, however, be rinsed in three changes of water, occupying about a minute, to get rid of the products of the clearing bath

The permanganate process, at any rate the acid permanganate, lends itself perfectly to the Bennett system of combined mercury and sulphide toning ("B.J.A.," 1909, p. 604). The tone depends on the quantity of 10 per cent. solution of mercuric chloride added to the bleaching mixture. For a trial, 30 minims to the ounce may serve. The mercury intensifies as well as darkens the tone. It must be followed by an additional clearing bath of very dilute hydrochloric acid and a little extra washing before sulphiding

A sulphide-toned print may be bleached in *acid* permanganate as easily as the original bromide. It may then be cleared, washed, exposed for about half a minute to daylight, or near the gas, and re-developed. The re-developer must be vigorous and contain no excess of sulphite The following gives the best results:—Diamidophenol. 1 grain; sulphite of soda 8 grains; oxalic acid, 2½ grains; carbonate of soda, 8 grains; water, 1 oz. The prints should be bleached right out, and the result will be a particularly fine engraving black Very rich prints may be obtained in this way. The mixed developer will not keep, and is not intended for ordinary use on bromide paper—"B.J." Nov 17, 1916. p 621.

In the use of the Greenall permanganate bleach, a correspondent has complained of (1) the waste of sulphide necessary to get rid of the brown permanganate stain, and (2) the occurrence of patches of deposit which refuse to darken to the same degree as the remainder of the print in the sulphide bath —"B.J.," July 13, 1917, p. 371.

Writing on these two points, T. H. Greenall points out that in order to avoid waste of sulphide the chief thing is to rinse the prints free from acid before putting them in the sulphide bath. There is no objection, however, to using a clearing bath before sulphiding (for removal of permanganate stain) providing that it is not too strong. It should also contain a little salt or hydrochloric acid. The following is a perfectly safe clearing bath for either permanganate or bichromate bleached prints:—Mix 4 drachms of 25 per cent. solution of sulphite of soda with, say, 3 ounces of water, and add 5 drachms of 25 per cent. solution of pure hydrochloric acid. Keep in tightly, and preferably rubber, corked bottles. Dilute 1 ounce with 3 or 4 ounces of water for use, and use only so long as the solution smells of sulphurous acid. Rinse the prints before sulphiding. The addition of the salt is not necessary when hydrochloric acid is used, but the presence of chloride is a safeguard in case the bleaching has not been quite complete.

As regards weak spots on prints, Mr. Greenall thinks that a possible cause is contact of the bleached prints with particles of undissolved salt (sodium chloride) or sulphite, both of which, when in strong solution, dissolve silver chloride. Spots which regain their density on re-toning the print are an indication that the original sulphide darkening bath was exhausted.

Mr. Greenall refers to the economy of using commercial fused sulphide in place of pure crystallised sulphide. The results with the former, as regards tone, are as good as with the latter. The commercial sulphide contains iron, which is precipitated in the solution as sulphide. This dark deposit should be allowed to settle and the clear liquor poured off when using the bath on rough-surface prints. The solution of the fused sulphide appears to keep in good working condition very much longer than that of the pure crystal sulphide.—"B.J.," July 20, 1917, p. 382.

Non-Bromide Bleach.—In view of the greatly increased cost of bromide and ferricyanide Harold Baker has recommended the use of a bleacher compo[illegible] of bichromate, salt and sulphuric acid, which besides being much cheaper, is free from liability to produce blue spots [illegible] prints. The formula is:—

[illegible]	3 ozs.
[illegible] sulphuric acid	10 ozs.
[illegible]	16 ozs.
Water	1 gallon

[illegible] may be [illegible] in a stoneware jar, and can be diluted to about [illegible] strength at the time of using. The solution acts in [illegible] way; sometimes the prints will bleach quite e[illegible] and [illegible]tely, at other times in a very patchy way, but this does [illegible] to affect the final result. After bleaching, a thorough washing is necessary, followed by a bath of salt and water to remove the yellow stain of the bichromate, and the prints must remain in it until the high-lights are quite free from yellow, and must be washed again before sulphiding.

The solubility of the yellow stain seems to vary with the brand of paper; some kinds need at least ten minutes in the salt bath.

before it disappears; in other cases the yellow stains may be removed by washing in plain water, but it is best to give all prints the salt water bath before sulphiding. In making up the salt bath it is necessary that the salt should all be dissolved before any prints are put into it; if any granules of undissolved salt are allowed to remain on the face of a print they will cause light marks.

It is best to use the bleaching solution once only, and then throw it away, and it is cheap enough to warrant this, and especially as there seems to be a loss of brilliance in prints that have been bleached in a solution that has been used before. When first poured out the soluti... hould be a deep, *bright* orange colour; with use it darkens ... deep, dull orange colour; it seems to have a tinge of black ... Such a bath will give flat prints, without any apparent loss ... tail in the picture, but the vigour and brightness disappear.

The colour of the finished print is exactly the ... that produced by the bromide-ferricyanide bath.

As a safeguard against blisters, a smal... mount of alum solution may be added to the sulphiding bath ... t will make the solution slightly cloudy, but seems to have ... bad effect, and it certainly does have the effect of reducing the number of prints spoiled by blisters.—"B.J.," De... 916, p. 659.

Commenting upon the above, T. H. Greenall says that if the sulphuric acid in the formula is the concentrated acid and is taken by measurement (not weight) the proportion of salt is too small. To be on the safe side, 10 ozs. by measure of pure sulphuric acid require at least 24 ozs. of salt, and as much as 2½ lbs. of the salt might be used without disadvantage. F...ther, with this amount of acid the solution might be diluted for u... with more than an equal volume of water.

As regards the use of alum in the sulphide bath, this plan has the objection that alum decomposes ... its own weight of sulphide, causing the evolution of th... offensive sulphuretted hydrogen gas, reducing the efficiency of the sulphide bath, and increasing its cost. He points out that the ... e smell there is of sulphuretted hydrogen, the more quickl... the sulphide bath losing its activity.—"B.J." Dec. 15, 1916.

Acid Bleachers for Sulphide Toning.—T. H. Greenall gives some very useful advice and formulæ on the cheaper bleachers, prepared with bichromate or permanganate, which can replace the mixture of ferricyanide and bromide. These bleachers, as he points out, are eliminators of hypo, and thus traces of hypo which would upset the ferricyanide-bromide bleach are without effect.

The most effective bichromate bleach is one prepared by adding 40 minims of 5 per cent. potass bichromate solution and 50 minims dilute hydrochloric acid (pure hydrochloric acid, sp.gr. 1.16, diluted with four times its bulk of water) to water to make 1 oz. This solution bleaches in from 1 to 1½ minutes, leaving usually a faint image. The most common cause of failure is omission to remove the

yellow stain before sulphiding. An anti-stain bath which acts rapidly and with perfect safety is made by mixing 1 dram of 25 per cent. solution of soda sulphite and 1½ drams of the dilute hydrochloric acid just mentioned with water to make 4 ozs. This clearing bath can be kept as a stock solution of four times the strength and diluted as required. It acts in from one to two minutes at the longest; should the stain not be completely removed in this time it may be taken as certain that the bath is used up. The bath is active only so long as it smells distinctly of sulphurous acid. Old solution should not be strengthened or returned to the stock, but thrown away.

After clearing, the prints only require rinsing in about three changes of water, occupying about one minute, and are then ready for sulphiding. The sepia tone obtained is exactly the same as with the ferricyanide bleach.

Mr. Greenall has worked out an acid permanganate bleach which is free from the objections (chiefly poor keeping quality of the bleaching solution) attaching to the formula previously originated by him ("B.J.A.," 1917, p. 378). This new bleacher is made up from two stock solutions:—(A) 40 grains of potassium permanganate in 20 ounces of water, as just described; and (B) 2 ounces of common salt, and half a fluid once of "syrupy phosphoric acid, 66 per cent., sp.gr. 1.5," with water to make 20 ounces.

It is essential that the salt be free from added farina, which is present in some fancy table salts. A salt which yields a clear solution in cold water will be satisfactory.

The working mixture consists of 1 dram of A and 4 drams of B, with water to make 1 ounce. This quantity is sufficient for a print of about 30 square inches or less, which works out at 4 ounces of solution for a 12 by 10 in. Should this prove insufficient, it is only necessary to add to the mixture in the dish a little more stock solution A. The solution does not become muddy, nor does it deposit any sediment on standing. With the addition of more A it may, in fact, be used for several prints in succession, whilst in all other respects it resembles the mixture of permanganate and hydrochloric acid previously described.—"Phot.," Jan. 16, 1917, p. 39.

SINGLE-SOLUTION SULPHIDE TONING.

Liver of Sulphur Toning—P. B. Keller uses the following formula for the sepia toning of Cyko prints:—

Water	...	130 ozs.
Liver of sulphur	..	60 grs.
Stronger water of ammonia, 28 per cent.	...	3 drs.

This, at a temperature of from 90 to 100 degs. F., is poured over the prints, the toning action being completed in from three to five minutes. It is not found necessary to keep the solution hot.—"B.J." (from "Portrait"), Nov 3 1916, p. 595.

It is found as a rule that liver of sulphur works better with slow papers than with the more rapid varieties. Some of the newer brands (of speed, between gaslight and bromide) are very satisfac-

tory for this method. It is necessary to harden the prints with alum or formaline before toning, or there will be a danger of melting, the "liver" having rather a tendency to soften the gelatine coating. The yellow stain over the whole print can be most quickly removed by giving the first washing in warm water. The ordinary commercial salt, as used for precipitating residues, should be employed, and the outside of the lumps should be rejected or used for precipitation only.—"B.J.," Nov. 10, 1916, p. 606.

Tellurium Toning.—The combination of a solution of tellurium dioxide or of one of tellurous or telluric acid with an alkaline sulphide such as soda sulphide has been patented in Germany by the firm of E. Schering. German patent No. 290,720. A somewhat similar process has been patented also in Germany by A. Spitze and L. Wilhelm, Vosendorf, Austria. According to this patent, No. 292,382, ordinary hypo (sodium thiosulphate) or ammonium thiosulphate is used in combination with tellurous or telluric acid or preferably with the sodium salts of one or other of these acids. —"B.J.," Nov. 24, 1916, p. 637.

The Carbon Process.

Enamel Effects by Carbon Prints.—The name "Princess Plaque" is given by the Autotype Company to a [illegible] print developed on the inner surface of a concave glass, which is subsequently filled with a backing of superfine plaster of Paris. The resulting picture gives the effect of an enam[illegible]. Th[illegible] of making these plaques was demonstrated by Mr. A[illegible] before the Croydon Camera Club. The glass first receives a coating of insoluble gelatine. The tissue, in order to facilitate working, is trimmed slightly smaller than the concave surface, and squeegeeing done partly with a squeegee cut down to about 1 inch width and partly with the thumb. After development the print [illegible] concave glass, is carefully dried with exclusion of dust.

The next operation is the filling of the concave glass with the plaster of Paris. The quality of the [illegible] important that sold for dental purposes "extra superf[illegible] [illegible]table. About 20 c.c.s. of cold water is placed in a cup and 30 grms. of the plaster dribbled into it, stirring gently all the [illegible], with the handle of a toothbrush) in order to prevent lumps or knots of plaster being formed. Air-bells do not matter: they disperse themselves. An ample quantity of the mixture is poured on to the concave glass, the excess smoothed off with a palette knife, and the plaque allowed to dry thoroughly. A year's experience has shown that the plaster has no tendency to leave the glass.

The process requires prints to be vignetted, and the results are most effective in warmer colours, such as terra-cotta or portrait purple. As the picture is viewed through the glass, single transfer prints appear correct. "B.J.," Mar. 16, 1917, p. 139.

Sury Direct-Carbon Process.—Working details of a carbon tissue requiring no transfer and possessing the facility of being worked up

in monochrome and colour by the after-applications of a powder were given in a demonstration at the Royal Photographic Society by the inventor, M. J. C. M. J. Sury. The special feature of the tissue is that a finely ground material, such as glass, is incorporated with the gelatine and pigment. (Eng. Pat. No 21,958, 1914. "B.J.," Oct. 2. 1914, p 748.)

The tissue is sensitised with a solution of ammonium bichromate either in water or (for more rapid drying) in a mixture of water and alcohol. Weaker or stronger sensitiser may be used according as one is dealing with weak or strong negatives. In printing, unless the negative possesses few contrasts, a special screen resembling bolting cloth is placed between the negative and the tissue. Exposure is controlled with an actinometer.

The tissue is developed within 2 or 3 hours of exposure by first soaking it face down in five or six changes of cold water for a total period of about 15 minutes. The tissue is then placed in water of 96 to 98 degs. F. for 2 minutes, removed to a sheet of glass, and the surface gently wiped with a flat camel-hair brush dipped in water of about 95 degs. F. The brush should be kept fully wetted, and be drawn from top to bottom, left to right, and diagonally across the tissue. At this stage the image gradually appears, development being complete in from 2 to 5 minutes.

The picture, which is of blue or lustre colour, according to the tissue employed, is finally completed (after drying) by pinning it to a board and applying the special powder pigments with a camel-hair brush. This pigmenting may be done in a straightforward way (the tissue taking up pigment in direct proportion to the values of the shadows and half-tones), or can be modified by rubbing the whole surface with pumice powder, when further pigment can be applied to any part, and particularly soft and artistic effects produced by this means. High-lights may be put in by touching with a piece of eraser sharpened to a point. After pigmenting, it is best, though not absolutely necessary, to apply a coating of fixative by means of an atomiser used about 18 to 24 inches from the print.—"Phot. Journ." Nov. 1916, p. 239.

Some further details of the process were given by M. Sury in a demonstration before the Croydon Camera Club.—"B.J.," Oct. 27, 1916, p. 589.

Literature of Ceramic Enamels.—A. Lockett has brought together references to past and present literature of photo-ceramics, or the making of burnt-in photo enamels. The only modern book now in print is "Photographic Enamels," translated from the French of Réné d'Heliecourt (Iliffe and Sons). Modern non-photographic books on enamels are:—

"How to Enamel." By H. M. Chapin. (Chapman and Hall. 4s. 6d.)

"Enamelling: Theory and Practice of Art Enamelling on Metals." By H. Cunyngham. (Constable. 6s.)

"Raw Materials of the Enamel Industry and their Chemical Technology." By Dr. J. Grünwald. (C. Griffin and Co., Ltd. 6s. 6d.)

"Enamels and Enamelling." By P. Randau. (Scott, Greenwood. 10s. 6d.)

The oldest reference is to a paper by A. Lafon de Camarsac, published in Paris by C. Chevalier in 1855—"Application de l'Heliographie aux Arts Ceramiques" but probably attempts to transfer and burn in a collodion film were made earlier.

The various methods for preparing enamels are (1) dusting on; (2) substitution; (3) carbon; and (4) photo mechanical.

(1) J. Wyard, in "B.J.," 1860, p. 118; F. Joubert, in "B.J.," 1861, p. 200; J. B. Obernetter, in "B.J.," 1874, p. 206; G. Wolff, in "B.J.," 1882, pp. 434 and 439; also the formula of W. Ethelbert Henry, in his handbook "Photo Ceramics," 1896. The use of fat essence of turpentine and of Canada balsam dissolved in turpentine is mentioned in "B.J.," 1859, p. 176, and 1860, p. 118.

(2) Substitution.—Grune, in "B.J.," 1867, p. 375; J. Solomon, in a handbook, "Vitrified Photographs in Enamel," published in 1874 and dealing also with the dusting-on process; N. K. Cherrill, in "Photographic Yearbook" for 1886; J. Von Noráth, in "B.J. Almanac," 1900, p. 957, which latter deals also with the carbon and photo-mechanical processes.

A full report of a demonstration by A. Hiscock appears in "Photography," October 5 and 12, 1893. The technique of firing is described by H. Towler in "B.J.," 1870, p. 135. Other general text-books are "Photographie Décorative Appliqué aux Arts Industriels," by V. Roux (Gauthier Villars, Paris, 1887) and the "Dictionary of Photography," in which references are given to other (German) works.—"B.J.," October 27, 1916, p. 579.

The Bromoil Process.

Pen and Ink and Bromoil.—E. L. Kent suggests that the effect of a mezzotint engraving may be obtained by first inking over the chief outlines of the subject in a bromide print or enlargement with black waterproof ink, then bleaching in a bromoil bleacher, and afterwards pigmenting with a brown pigment in imitation of the colour of a mezzotint engraving.

After inking (with Higgins's waterproof ink) the print should be left for at least one hour for the ink and the gelatine under it to harden. The bromoil bleacher should be one which does not require an acid bath, the effect of which is to impair the line drawing which has been put on. After fixing and washing, the print may be dried and additional work put in with the Higgins's ink. For pigmenting, it is then soaked in tepid water and pigmented with as gentle a brush action as possible. Vigorous pigmenting will break the inked lines, although a little of this may sometimes add to the effect by taking off any hard appearance.—"A.P.," Jan. 22, 1917, p. 54.

Copper Bromoil Bleacher.—A bleaching solution for the Bromoil process recommended by Würm-Reithmayer is:—

Copper sulphate	30 gms.	260 grs.
Potass bromide	20 gms.	175 grs.
Chromic acid	2 gms.	17·5 grs.
Water	1000 c.c.s.	20 ozs.

The copper sulphate and chromic acid should be chemically pure and the former free from iron. The bleacher does not require the use of a subsequent acid bath.—"B.J." (from "Phot. Korr."), Feb. 16, 1917, p. 81.

Dr. S. Brum do Canto has contributed further notes from his experience in the technique of the Bromoil process, following those in "B.J.A.," 1915, p. 493. Bromide paper found best for this process, Wellington "thick, smooth, ordinary." Another good paper, Kodak, "thick, smooth, Platino-matt." No need for a print of very great contrast: a hard print fixes pigment strongly in the shadows, and thus blocks up detail in these parts.

A developing formula giving as good results as amidol is:—

Hydroquinone	32 gms.	283 grs.
Monomet, White Band	4 gms.	35 grs.
Soda sulphite (anhydrous) ...	100 gms.	2 ozs.
Soda carbonate (anhydrous) .	60 gms.	500 grs.
Potassium bromide.	2 gms.	20 grs.
Hot water to make .	1000 c.c.s.	20 ozs.

Monomet must be dissolved in 50 c.c.s (2 ozs.) of water and added to the complete solution of other chemicals. On cooling the solution becomes turbid by small crystals, so that it must always be shaken before use.

The stock solution keeps well. It is mixed with two or three times its bulk of water to form the working developer. The prints show even greater relief than when using amidol. Development should last at least 60 seconds, but not longer than 90 seconds; the print is then washed and fixed in a bath consisting of 50 per cent. hypo solution mixed with an equal bulk of saturated solution of boric acid. The print is then thoroughly washed.

A modified bleaching formula, due to Namias, is found to be the best ever used by Dr. Do Canto. It is:—

Copper sulphate (crystals). ...	100 gms.	2 ozs.
Potassium bromide . . .	80 gms.	700 grs.
Potassium bichromate	10 gms.	90 grs.
Hydrochloric acid	5 c.c.	40 minims
Water to make up	1,000 c.c.	20 ozs.

The water should be hot and the copper sulphate dissolved first in it; then the other chemicals. The formula is still further somewhat improved by substituting ammonium bichromate for the potass salt. The working bleaching bath, which can be used several times, consists of one part of above stock solution mixed with

nine parts of water. As necessary (after use) a drop or two of hydrochloric acid may be added when it is found that bleaching takes longer than three minutes.

The bleached print is of faint brown yellow colour. It is transferred directly into a 1 : 200 solution of hydrochloric acid and kept there for one minute with constant rocking. The print then bleaches almost completely, the image being very faintly visible. By use of this acid bath the bleacher is more quickly washed out, ten minutes in running water being sufficient.

It is then fixed, either in plain hypo 5 ozs. in 20 ozs. of water, or in the hypo-boric bath given above. Fixing should be for not longer than eight or ten minutes and the print then washed for 20 or 30 minutes.

As suggested by Namias, it is better to dry the print before pigmenting, and sometimes to make it bone dry by exposing it to a temperature of about 140° F. The latter process is useful when a flat or very light print has to be used, as it tends to increase contrast and helps matters, especially in conjunction with short soaking in very hot water (see below).

In the ordinary way the print is allowed to soak in cold water for some twelve hours in summer (24 hours in winter) before pigmenting. If the print is of good average quality further treatment, at any rate in summer, with hot water is not necessary. In very cold weather the print may have two or three changes of water at 90° F. for 8 or 10 minutes just before pigmenting. For light or under exposed prints, it is better to soak for the shorter time: for prints which are too dark or over-exposed, soak for 24 hours in cold water, and follow by 20 or 30 minutes in water at about 120° F. With flat prints or for increase of contrast, place, without previous soaking, in water at 120° or 130° F., renewing this hot water every little while. Very strong and sharp relief is thus obtained: the water containing the print is allowed to cool and pigmenting done at once.

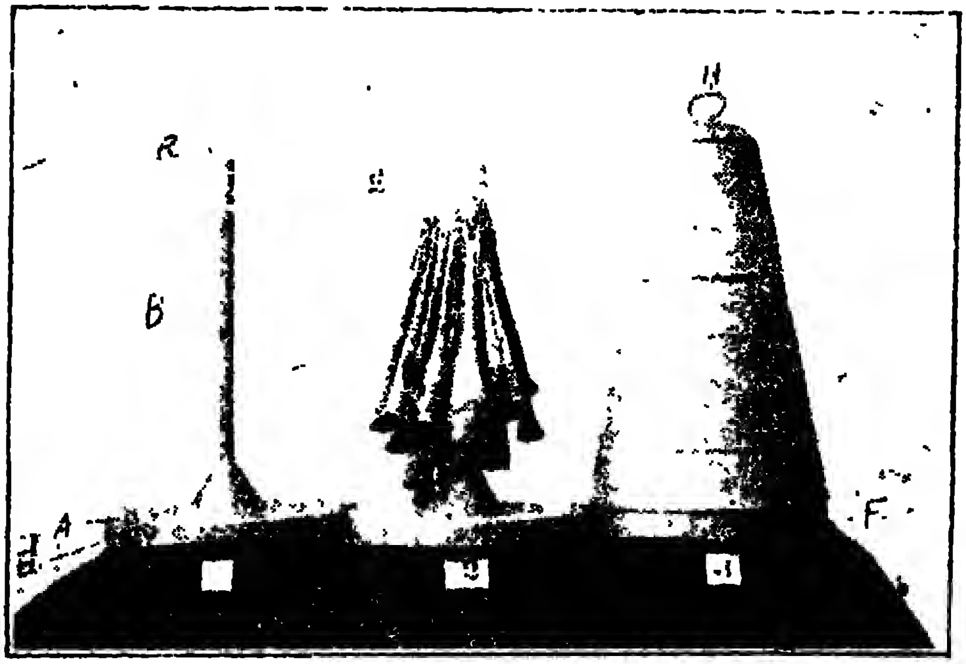
Where very hot water is used, or in very hot weather, it is well to immerse the print for not more than three minutes, and only after the required relief has been obtained in:—

Potash alum	20 gm.	175 grs.
Glacial acetic acid	10 c.c.	90 minims
Water to make	1,000 c.c.	20 ozs.

After use of this bath the print must be thoroughly washed in five or six changes of tepid water (90° F.). The hardening action of this solution is very slight, and does not stop swelling when used at this stage, yet it is quite enough to give to the film the necessary strength to withstand the strokes of brushes without being affected. Its use is particularly recommended in all cases where there are large white surfaces, such as in portraits with white backgrounds.

Dr. Do Canto carries out pigmenting on the lines described in "B.J.A.," 1915, p. 494, adopting either the "inking up" or "clearing down" system. In the one case the image is built up

by means of successive touches of a brush carrying greasy ink more or less softened by various mediums. In "clearing down" the whole surface of the print is covered with a film of liquified or greatly thinned ink and the image then developed by successive use of rollers or brushes. This latter method, it is stated, is used



by a German commercial enlarger, E. Blum, in carrying out pigmenting with rollers; the ink is dissolved with turpentine.

Dr. Do Canto describes the convenient holder for the pigmenting brushes shown in the sketch and consisting of a wooden base, A, thickened with lead, E, and supporting a zinc-covered iron rod, B, to the top of which is fixed a copper loop, C. The brushes are attached to this loop by a number of tape strings, D, and are covered, when not in use, by an extinguisher hat provided with clips (F) and handle (H).—"B.J.," April 27, 1917, p. 218.

Platinum Printing.

Palladiotype.—Under this name the Platinotype Company have introduced a printing paper which in many respects resembles Platinotype, but is coated with salts of palladium in place of platinum salts. At the time of writing (November, 1917) the paper is issued only to give prints of sepia tone with a Japine surface, the results closely resembling those with Japine sepia Platinotype.

The chief point of difference between palladiotype and platinum paper is that the developing solution and that used for clearing the

prints are of the same composition, and consist of 2 ozs. of potass citrate and 50 grains citric acid dissolved in 20 ozs. of water.

At a demonstration before the Croydon Camera Club Mr. W. H. Smith, technical manager of the Platinotype Company, dealt with the properties and handling of the new paper. In comparison with sepia Japine Platinotype the colour of the prints was a shade cooler: permanency under all ordinary atmospheric conditions (exposure to light and air, etc.) should be equal to that of Platinotype. A palladiotype, however, possesses greater latitude in printing: by over-exposure to the extent of 25 per cent. or more a good though darker, print was obtained with all shadow detail and without sign of solarisation. The paper requires to be stored and printed in exactly the same way as Platinotype and with the same precautions against damp. Slight dampness of the paper tends to softer prints, and may, on occasion, be utilised.

The exposed print is immersed in the developing solution (see above) and allowed to remain for a minute or two. A correctly exposed print cannot over develop. Ten ozs. of the developing solution suffice for fifty half-plate prints.

The colour of the prints is somewhat affected by the temperature of the developer. At 45 degs. F. the tone is somewhat colder and the prints somewhat more "contrasty" than at 60 to 65 degs. F. At 100 degs. F. the tone is warmer, but with less contrast. The developer should not be used warmer than 100 degs. F. A little bichromate solution (about 5 minims of a 2 per cent. solution potass bichromate) may be added to each ounce of the developer when printing from flat negatives.

In order to free the print from the iron sensitising salts they are next passed through two clearing baths of the same composition as the developer, remaining in each for at least fifteen minutes. If preferred, and for the sake of economy of the clearing bath, the prints may be washed in two changes of *distilled* water as they come from the developer and then given a single clearing bath. The last clearing bath should show no tinge of colour; as soon as it becomes coloured the developer is discarded, No. 1 clearing bath takes its place, and a fresh bath is provided for No. 2.—"B.J.," Feb. 2, 1917, p. 60.

Palladiotype Stop Bath.—A stop bath for checking development of a Palladiotype print is recommended by W. H. Smith as follows:—Hydrogen peroxide (20 vol.), 1 part; distilled water, 9 parts. Distilled water is essential. The print is removed from the developer and allowed to remain in this stop bath for a few seconds, being then transferred to the first clearing bath. The latter can still take the place of the developer, as directed above. The peroxide carried into it does not alter the gradation of prints afterwards developed in it, but this is not the case if the bath be left exposed to the air over-night.

The stop bath is useful, inasmuch as prints can receive exposures up to 50 per cent. beyond the correct time, and still, by its aid, be obtained of excellent quality and gradation, though naturally on the dark side.—"B.J.," June 29, 1917, p. 334.

Iron Printing Processes.

(Other than Platinum.)

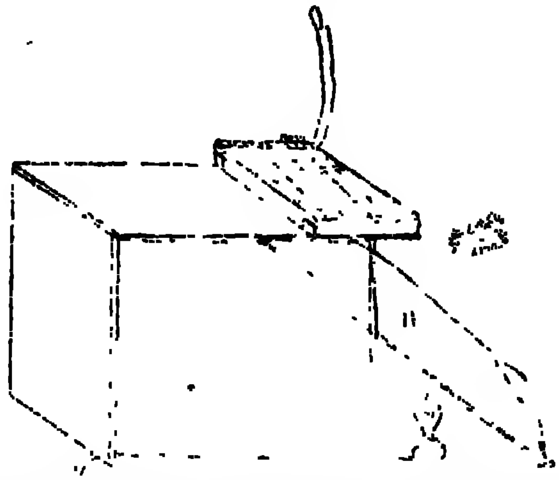
Ferro-prussiate Sensitiser.—E. Valenta has made trial of a new ferric salt as the sensitive material in the coating of ferro-prussiate blue-printing paper, in place of ferric ammonium citrate. The new compound is a salt of diglycolato-ferric acid obtained by mixing solutions of ferric chloride with those of potassium or sodium glycolate. The ammonium salt is prepared by treating ferric hydroxide, suspended in water, with a corresponding excess of glycolic acid and then adding the calculated quantity of ammonia. Trial was made of this ammonium salt in ferro-prussiate printing by coating paper with a sensitiser formed by mixing the two following solutions.—(A) Ammonium salt of diglycolato-ferric acid, 2 gms.; glycolic acid, 1 gm.; water, 9 c.c.s. (B) Potass ferricyanide, 1 gm.; water, 10 c.c.s. Paper sensitised with this mixture was found to print very rapidly and to yield copies of fine, intense, indigo-blue colour, such as are not yielded with ferric ammonium citrate. But the sensitised paper has exceedingly poor keeping quality, fogging in the course of a day or two in the dark, and thus yielding prints with a bluish ground. It was not found possible to avoid this drawback by addition of oxidising substances to the sensitiser. Valenta concludes that the usefulness of the new compound is limited to its admixture with ordinary ferric ammonium citrate for the purpose of producing a somewhat quicker printing paper, and one yielding a finer colour of image.—"B.J." (from "Phot. Korr."), Feb. 9, 1917, p. 70.

Trimming and Mounting Prints.

Trimming Prints to Circles.—J. Tear describes how to make a trimmer for circle prints by fitting a blade, consisting of a piece of sharpened clock-spring, to a pair of compasses. The blade is inserted in the pen part of the compasses and bound in position with thin copper wire. The extreme point of the spring on one side is brought to a good edge on a piece of oil-stone, and it must be kept at this by frequent applications. To cut a circle well, hardly any pressure on the blade should be necessary: it should be so sharp that a mere gliding stroke suffices. The compasses after being thus altered may also be used to cut masks and discs when circular forms of such appliances are required, and may also be found useful in a variety of other ways.—"Phot." Nov. 28. 1916, p. 367.

Trimming Prints for White Borders.—A labour-saving device for use when trimming prints which have been printed through a mask for white borders is described by P. B. Keeler. Any kind of a box is used, and one end taken out. Then a sheet of glass is placed diagonally inside to allow trimmings to slide out into the waste-basket, as shown (A) in the accompanying rough sketch. Then an ordinary electric wall-socket is placed on the bottom of the box so that the light will be directly under the cutting edge of the trimmer, and is attached by an ordinary extension cord so that the

apparatus can be put out of the way when not in use, and can be set on a chair or wherever convenient to use. The light shines



through the paper, and the exact width of the margin can be seen in an instant.—"B.J." (from "Portrait"), Jan. 5, 1917, p. 10.

Non-Cockling Glue Mountant.—Harold Baker makes a mounting solution suitable for the mounting of prints in albums by soaking about half a pound of best glue in cold water for 10 or 12 hours until thoroughly soaked. The water is drained off, and the vessel containing the glue put in a saucepan of hot water. When melted, methylated spirit is poured in very slowly, with constant stirring, until the mixture is about as thick as milk. If the spirit is added too quickly it will take up the water from the glue and send it to the bottom as a lump of jelly, but persistent stirring while hot will mix it up again. When used, it must be kept hot and spread over the dry prints with a stiff brush, going over the edges the last thing before laying on the mount, which should be marked where the print is to go. This is still a good plan of mounting prints in books when a hot-mounting press cannot be used.—"B.J.," March 2, 1917, p. 115.

Glycerine having been rendered extremely scarce owing to its importance for military purposes, W. E. Debenham has given a formula for a non-cockling glue mountant in which the glycerine is replaced by golden syrup. The spirit may be mixed in without clotting if it is stirred in hot, or even warm. This is conveniently managed by putting the spirit into an ordinary flat six or eight ounce medicine bottle; stand first in a bowl of warm and then of hot water.

A formula found successful is as follows:—

Glue	2 ozs
Water	4 ozs

Let the glue swell in the water for a night or longer. Then melt in a water bath, and while hot add

Golden syrup	½ oz
Methylated spirit, warm	3 ozs.

Pour into the glue in a thin stream, stirring the while.

Prints to be mounted should not have the slightest inward curl. If that curl exists it may be removed by laying the print, face downwards, on a clean sheet of paper, and drawing it rather forcibly under the edge of a flat rule, or the edge of a cutting shape or smooth-edged piece of glass. The mountant should be warm, but if too warm the coating may be too thin.—"B.J.," March 9, 1917, p. 127.

Renovating Dry-Mounting Plates.—C. W. Roberts recommends the following process for the renovation of dry-mounting plates the surfaces of which have become defaced by pieces of shellac tissue (protruding from mounts) attaching themselves:—The plate is first rubbed down with emery until all the marks are obliterated and it has a perfectly even, glossy surface. Then, if the final surface is required to be semi-matt, it is finished off with a fine knife-polish and afterwards, if necessary, with pumice powder. If it is required to be of matt surface the method is to place it in a weak bath of sulphuric acid and to etch until the surface attains the even matt required, which will be in about 15 minutes.—"B.J.," Oct. 27, 1916, p. 596.

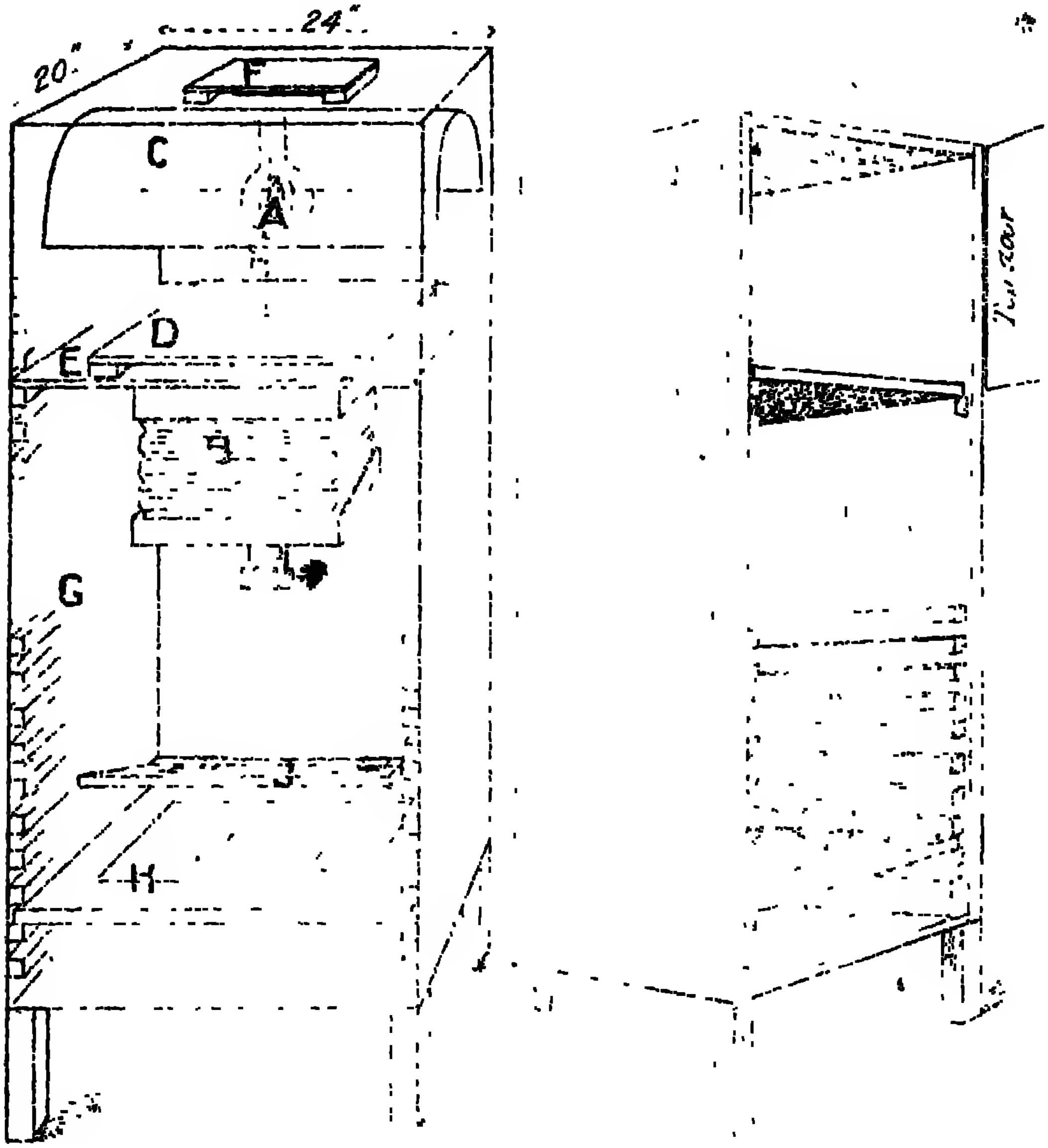
Enlarging.

Artificial-Light Vertical Enlarger.—W. Marshall has also designed a vertical enlarger on the lines of that of Dr. D'Arcy Power ("B.J.A.," 1917, p. 394), but using a half watt lamp as the source of light. The apparatus is intended chiefly for the making of enlargements from amateurs' negatives, since it is operated very quickly and occupies very little floor space in the developing-room. In the drawing, A is a single half watt lamp of 600 c.p. It is placed within a white lined reflecting screen C, measuring about 20 inches in length, 9 inches in depth, and 17 inches across, dimensions which are pretty nearly those of the upper (light-box) portion of the enlarger. Three inches below the tip of the lamp is placed a screen, D, of opal glass, mounted in a light wooden frame and with thicker end-on spacers, so that the opal is half an inch above the negative, which latter is held in a carrier provided in an aperture of what may be called the negative shelf, E, of the enlarger. The lamp gives out a good deal of heat, and it is necessary to provide vents, F, on the top and at each side for the proper ventilation of the light-box.

There is nothing special about the camera. Any good-size camera of old pattern, preferably one with a front focussing pinion head, can be fitted. The lens requires to be of short focus. Mr. Marshall uses one of 5½ inches focus and f/4.5 aperture, mounting behind it on the camera front one of the Kodak slide-by orange shutters.

The supports for the easel take the form of a series of side bars, G, which preferably should be of hard wood—Mr. Marshall's are of teak—and are numbered to correspond with a given degree of enlargement with the particular lens used in the apparatus.

The easel consists of a flat board, H, with tongued ends and having hinged to its upper side a light frame, J, fitted with plate-glass. This frame has only to be lifted from the front in order to allow of the bromide paper being laid in position, and



Artificial-light Vertical Enlarger.

A, Half-watt lamp; B, camera; C, oval matt white reflector; D, opal glass, half-inch above negative shelf F; H, easel board, sliding in grooves G; J, plate-glass in frame.

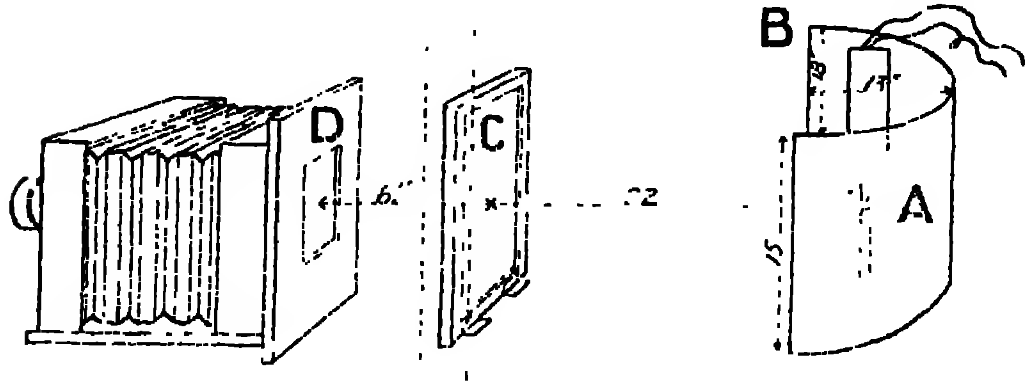
of being held flat when the frame is lowered again. The easel is covered with paper marked with the outlines of the customary sizes of enlargements, these marks serving to permit of the paper being placed in the proper central position.

The total height of the apparatus is 6 ft. 10 in., a height which

fully provides for such degrees of enlargement as are commonly wanted. If some small portion of a negative is required to be enlarged upon a much greater scale, it is better to make use of a lens of shorter focus, such as 3 or 4 in., rather than to incur the inconvenience of bringing the easel almost down to the floor level. If the camera does not rack in close enough for the use of such a short focus lens it is an easy matter to fit a recessed box to carry it. But with the apparatus as described—i.e. with 5¼-in. lens, enlargements up to nine times (1-in. to 9-in.) can be made. The time of exposure in enlarging from half-plate to whole-plate on bromide paper is about fifteen seconds.—"B.J.," March 30 1917, p. 160.

Arc light Enlarger Without Condenser.—W. Marshall uses an arc lamp without a condenser, securing the advantages of a quick yet highly diffused light, which minimises the reproduction, in the enlargement, of retouching marks on the negatives. Since others who have tried this plan have sometimes found it difficult to get even illumination, it may be useful to give a description of the apparatus which, in this respect, is found perfectly satisfactory.

The arc lamp, A, is placed just within a curved metal reflector, B,



Arc light Enlarger without Condenser.
A, arc lamp. B, semi-cylindrical matt-white reflector. C, single-flashed opal glass. D, negative.

of depth 13 inches, width 18 inches and height about 15 inches. The inside of this is painted a matt white. The arc lamp is of open type, consuming about 17 amperes of current and yielding an arc of about half an inch from a voltage of 110. Mr. Marshall places the arc, with its attached reflector, on a heavy standard in a passage running outside a workroom, which can be quickly darkened for the use of the enlarger. A small opening, about 15 by 15 inches, in the wall of this workroom is fitted with a hinged frame, C, 14 by 14 inches, carrying one thickness of single flashed opal glass. The surface of the opal is 22 inches from the arc. On the further side of this opal diffusing screen and 8½ inches distant from it is fixed the stage D for the negative carriers, behind which, again, upon the workroom bench, is placed the front portion of an ordinary

enlarger fixed in alignment with a pair of runners carrying the enlarging easel. The outfit, as fitted with an $f/4.5$ anastigmat, allows of enlargements of whole plate size from a half-plate negative being made on bromide paper with a time of exposure which is about five seconds.—" B.J.," March 30 1917, p. 159.

A Fitment for Combination Enlarging.—As a means of facilitating the use of two or more negatives—e.g. in printing a sky into an enlargement—a most useful accessory for the enlarging easel is a light-tight flexible blind, affixed to the easel, which latter should be several inches larger each way than the paper which is being employed. The blind should consist of two or three thicknesses of some fairly closely woven material sewn together round the edges, the top edge being tacked to the top of the easel and the bottom edge tacked to a broomstick or a stout blind lath. This blind is lifted up before the exposure is made and then dropped again while the negative is changed, the paper being protected perfectly, and much time and trouble saved.—" B.J.," Nov. 10, 1916, p. 606.

Enlarging to Scale.—A. Lockett has devised a ready method of placing the enlarging easel in order to obtain an enlargement strictly upon some required scale. The negative, or preferably one of the ruled glass plates sold for focussing enlargements, is first focussed sharply on the easel (without stopping down the lens) so that the enlargement is appreciably smaller than the one required. The position of the easel, or of any portion of its sliding support, is marked on the bench or rail. The length of any object in the enlargement is measured. Calling this measurement A, then the distance which the easel will have to be moved away from its marked position, i.e. (further from the lens), is

$$F\left(\frac{B-A}{N}\right)-\left(\frac{FN}{A}-\frac{FN}{B}\right)$$

where F is the focal length of the lens, N the length of any object in the negative, A the length of the same object in the trial enlargement, and B the desired length of the object in the actual enlargement.—" B.J.," June 8, 1917, p. 297.

The above formula can be expressed in different forms according to the particular kind of work which is being done. Thus the difference between the position of easel (or negative) found at the preliminary trial and its correct position for the final exposure is equal to

$$F(B-A)\left(\frac{1}{N}-\frac{N}{AB}\right) \qquad (1)$$

This is the most convenient form when it is wished to make an enlargement of a particular size.

When it is wished to enlarge to a particular number of diameters the most convenient form for this difference in the two positions is

$$F\left\{R+\frac{1}{R}-\left(\frac{A}{N}+\frac{N}{A}\right)\right\}$$

where R = the degree of enlargement $= \frac{B}{N}$.

Where one special standard test negative is used in adjusting the apparatus in the first instance the most convenient form of the formula (for the difference) is

$$F \left\{ R + \frac{1}{R} - \left(A + \frac{1}{A} \right) \right\}, \qquad (3)$$

where the unit mark on the special test negatives is 1 in. or 1cm.; A being, of course, likewise measured in inches or cms.

In the special case where one is copying full size the formulæ take the very simple form of

$$F \frac{D^2}{A}. \qquad (4)$$

which is derived from the previous one by recollecting that R = I and that A—I is simply the excess of deficit of A over the unit, and can be read directly off the easel. A–I is thus equal to D, this substitution giving the above simple formula.—"B.J.," July 6, 1917, p. 350.

Correction of Distortion Due to Tilt When Enlarging.—The following rule is given by "Pica" for the angling of the negative to the enlarging easel when correcting the converging or diverging lines in an architectural photograph due to the camera having been tilted upwards or downwards (at the time of exposing the plate) without using the swing back. At the time of such exposure it is necessary that a note should be made of the angle at which the back of the camera is tilted (call this X) and also of the focal distance from lens to plate (call this Y). The third factor in the calculation is the distance from lens to negative when making the enlargement. (Call this distance Z.)

The correct angle for the copying easel will then be as follows:—

$$\text{Copy Angle} = X \times \frac{Z^2 + Y^2}{2 \times Z \times Y}$$

$$\text{The angle for negative} = X \times \frac{Z^2 - Y^2}{2 \times Y \times Z}$$

For example, suppose the camera back to have been tilted at an angle of 24 degrees in making the negative, the distance from lens to plate to have been 6 ins., and the necessary distance to secure focus in enlarged copy is, from lens to negative, 8 ins., the copying angle will equal—

$$24^0 \times \frac{8^2 + 6^2}{2 \times 8 \times 6} = 24^0 \times \frac{25}{24} = 25^0$$

Negative angle will equal:—

$$24^0 \times \frac{8^2 - 6^2}{2 \times 8 \times 6} = 24^0 \times \frac{7}{24}$$

From the above calculations we find, therefore, that if the copy be slanted at an angle of 25 deg., and the negatives swung in its

carries at an angle of 7 deg., the distortion will be fully corrected. For general work, however, it will be quite near enough if the amateur worker cants negative and copy-stand in a one to three or one to four ratio.—"Harrington's Photographic Journal," Oct. 20, 1916, p. 323.

Lantern Slides.

Adding Clouds to Lantern Slides.—F. F. Maples uses successfully a method employed by the late Horsley Hinton. The apparatus required is a lantern for the illumination of the cloud negative, which is placed in the carrier. Opposite to this is fixed a camera with a plate-holder or carrier to take a plate of lantern size. A piece of ground glass is first placed in the camera, ground side outwards, and the cloud obtained in position and focussed. The lantern slide to which the cloud is to be added is then placed in contact with a lantern plate, film to film, and exposure made in the camera. The image on the lantern slide acts as a mask, and allows of a cloud transparency being made which fits the picture on the lantern slide. The lantern plate is then developed and fixed in the usual way, and any cloud image formed on the landscape part of it removed with a reducer. It then only remains to bind the two plates together to produce the finished slide.—"B.J.," Feb. 16, 1917, p. 91.

Binding Lantern Slides.—A. E. Bawtree has invented, and shown at the R.P.S. Exhibition, a method of "binding" lantern slides, etc., without the aid of binding strips. It consists in applying a thick warm adhesive to the two edges of the glass. The adhesive attaches itself as a highly cementive ridge along these two edges. By application of a special powder this ridge is then caused to contract, leaving the edges of the glass quite flat and firmly securing the two glasses together. The cement penetrates a fraction of an inch between the two glasses, but the presence of a paper mask, even though of more than ordinary thickness, does not (so it is claimed) interfere with the effectiveness of the method. It would seem that the security of the two glasses and the exclusion of air by the imprisoned film and edging of the cement are just as complete as when a paper binder is used, whilst the method is much more rapid.—"B.J.," Oct. 12, 1917, p. 522.

VI.—COLOUR PHOTOGRAPHY

Patents for Colour Photography.—The chronology of the patent specifications relating to colour photography commenced in the monthly "Colour Photography," Supplement to the "British Journal of Photography," Jan. 4, 1907, is concluded with the issue of Dec. 6, 1907, p. 96. All current patents are dealt with week by week in the "British Journal of Photography," and are entered in the annual index under (1) Colour photography and (2) Name of patentee

Lenses for Colour Photography.—A. Polack has been granted a patent in reference to the use, for colour photography, of a lens which is not corrected for chromatic dispersion, though corrected as far as possible for spherical aberration. It is claimed "that the most favourable colour and contrast effects are thus obtained." —Eng. Pat No 16487, 1914 "B.J." Aug. 24, 1917, p. 439.

Two-Colour Processes.

Two Colour Photography—C. F. Jones has patented a system of making negatives through a red and a green filter, dyeing the positives from the first, green or blue, re-sensitising, placing in register behind the positive from the green negative, exposing to light, and finally dyeing to produce a red picture with the green blended therewith.

The invention consist in immediately re-sensitising and dyeing the first positive (after toning) before exposing it under the untoned positive

The process thus consists of the following stages :—

Making a red-sensation and a green-sensation negative of the subject.

Preparing a positive from each negative and developing.

Calling the red sensation positive No. 1, and the green-sensation positive No. 2, positive No. 1 is toned to a colour different from its filter, *e.g.* blue. It is then treated in a mixed bath of bichromate and yellow dye, and after this re-sensitising is dried. Positive No. 2 is used as a printing negative. No. 1 is placed on it in register and exposed to light. No. 1 is then developed by washing, is then dyed red, again washed and dried. Owing to the partial-hardening of the gelatine surface by the bichromate and

the exposure, the red dye penetrates only into places representing negative No. 2 (green-sensation).—Eng Pat. No. 105,380. "B.J.," May 25, 1917, p. 277.

Hess-Ives Colour Prints.—The experience of a practical worker (K. Struss) in the manipulation of Hiblock and preparation of the colour prints from sets of Hiblock negatives is published in "American Photography," Aug. 1917, p. 437.—B.J. "Colour Photography" Supplement, Sept 7. p. 33, and Oct. 5, p. 37, 1917.

Three-Colour Processes.

Dye-Transparencies.—The Brewster Film Corporation (assignees of Hoyt Miller) has patented a method of producing dye images which is along the lines of the diachrome process of Traube ("B.J.A.," 1909, p 631) and Tauleigne and Mazo ("B J.A.," 1912, p. 652), and consists in bleaching the silver image with a solution of iodine in potassium iodide, subsequently dyeing up with a colouring matter which is fixed by the silver iodide, which latter, according to the invention, is obtained in an almost transparent "hydrosol" form. The process recommended (for cinematograph film) is to bleach in—

Potassium iodide	5 gms
Iodine	0.15 gm.
3 per cent. acetic acid (glacial)	5 c.c s
Water to make	100 c.c s

This treatment is continued until the original image entirely disappears or is replaced by a faint image, having its high lights more or less stained with iodine, which usually takes from one to two minutes. The film is then washed and treated with a 1 to 2 per cent. solution of sodium bisulphite or other reducing agent to remove the iodine stain, after which the film is washed. The film should now be perfectly transparent, with no image perceptible, except in slight relief, if the original image were rather heavy. The film is then sprayed with or immersed in an aqueous dye-bath—for example, of malachite green or xylene red. The strength of the dye-bath is immaterial. The time of dyeing may last from a few seconds to an hour. After thorough washing to clear the high lights the film can be dried. Considerable variation in the composition of the bleach is permissible if, in general, the free iodine is present in the solution of potassium iodide in the proportion of from 1 per cent. to 4 per cent. of the iodide. If the iodine content is below 1 per cent. of the potassium iodide, the finer details of the image are destroyed by the action of the bleach. This is particularly noticeable if the potassium iodide is in 10 per cent. solution, even when the iodine is present in the proportion of 1 per cent. to the potassium iodide, showing that, as the potassium iodide solution is concentrated, the relative proportion of iodine must be greatly increased.

Higher concentration of the potassium iodide than 10 per cent. is not advisable, as the gelatine on the film is seriously attacked

within thirty seconds, even if the bleach be cold. On the other hand, if the potassium iodide concentration be reduced, the iodine in proportion to the potassium iodide must be further reduced, *i.e.*, with a potassium iodide solution of 1½ per cent. it is advisable to reduce the proportion of iodine to a maximum of less than 2 per cent. The acetic acid in the bath, while not absolutely required, tends to give more uniform action, and also to keep the gelatine in better condition.

Another excellent bleach is composed of potassium iodide, acetic acid, and potassium bichromate, say, in about the proportion of 5 gms. of the iodide, 5 c.c.s. to 25 c.c.s. of the acid (3 per cent. solution), 5 c.c.s. to 25 c.c.s. of the bichromate (1 per cent. solution), and water to make 100 c.c.s. Eng. Pat. No. 100,098, "B.J.," June 8, 1917, p. 303.

Colour Prints and Transparencies.—J. H. Christensen has patented a method according to which certain photographic films become more porous in the places where development has taken place, this difference being utilised for the application of dyes or for the production of a printed surface. For example, glass plates are coated with gelatine containing a dye and then receive a collodio-bromide film, which is rendered porous by addition of glycerine, etc. One of these plates is printed under the negative, developed, washed, and treated for some minutes with a weak solution—1 : 100 to 1 : 1000 of liver of sulphur, which fills up the pores where no development has taken place. Such a plate can then be used for taking off colour impressions on paper or on a transparent film. Eng. Pat. No. 103,890. "B.J.," May 11, 1917, p. 251.

One-Plate Three-colour Processes.

PROCESSES OF PREPARING SCREEN-PLATES.

Under this heading are described processes which at the time of writing (Sept. 1917) are not on the market.—Ed. "B.J.A."

Phosphorescent Colour Screen Plates.—A somewhat curious process figures in a French patent, that of L. Paris and G. Picard. In the making of three-colour mosaic screens for the production of colour-screen plates, it is proposed that grains of phosphorescent zinc sulphide should be used instead of starch grains. The grains are to be saturated with a concentrated solution of alum and then treated with ammonia in order to produce a thin coating of gelatinous alumina which can be stained by treatment in a suitable dye solution.—"Journ. Soc. Chem. Indus." 1916. "B.J." "Colour Supplement," Feb., 1917, p. 8.

Ceramic Colour Screen Plates.—A recent German patent, No. 291,575, of September 11, 1914, which is an addition to a previous

patent, No. 283,551, relates to the manufacture of multi-colour glass screen-plates. The patentees, H. Wieland, Hamm, and E. Mohr, Sudenberg, Magdeberg, specify the use of glass globules (for each colour) of a different melting point from those of other colours, so that, on heating, the globules of one colour melt first and then those of the other colours in succession. This plan is adopted in order to obtain an even surface free from uncovered portions, and at the same time to avoid the fusion of globules of different colours and the consequent production of mixed colours in the coating.

According also to the Society of Chemical Industry, details of a ceramic method of producing a colour screen-plate are given in a recent United States patent, No. 1,175,224, granted to W. F. Bleecker, Canonsburg, Pa. For the preparation of the screen the colour elements are obtained in spherical granules of a transparent and fusible substance, such as glass, by running a fine stream of the powdered material into a hot air blast which heats the granules to the melting point, when they become spherical by the action of surface tension, while the separating action of the blast prevents coalescence. The spherical granules are sifted to uniform size and then mixed in the desired proportion of the colours.—"B.J." Colour Supplement, Dec. 1, 1916, p. 48.

SCREEN PLATES ON THE MARKET.

THE LUMIÈRE AUTOCHROME.

Protecting Autochromes.—F. J. Hargreaves recommends cementing the cover-glass to the Autochrome with Canada balsam on the ground of the added brilliancy and smoothness of surface and the particular benefit in projection. At the same time the transparency is made completely damp-proof. The Autochrome and the cover-glass, are both made thoroughly warm near a fire and the balsam applied to the surface of the Autochrome in two smooth streaks running from corner to corner, thicker in the centre where they cross and tapering towards the corner. On then applying the cover-glass, the balsam can be made to spread evenly to the edges with very little trouble. The two plates should not be squeezed vigorously together. The cover-glass should be gradually lowered from one edge so as to avoid formation of air-bells. Some few air-bells are unavoidable, but the majority squeeze out, and any which remain, if no larger than a pin's head, disappear in course of time.

After the balsam has worked through all four edges of the pair of plates, the covered transparency is put away for a day or two in a horizontal position and in a cool and well-ventilated place. The balsam which oozes out is then removed, and after another few days (for the edges to harden) the plates can be bound up as usual and the glass surfaces cleaned with benzole or petrol.—"Phot.," Jan. 16, 1917, p. 48.

The Bleach-Out Process.

Bleach-out Colour Process.—J. Szczpanik and F. Habrow have described exceedingly elaborate details of manufacture of paper for the bleach out process. One claim is for a process of making coatings or emulsions for use in the bleach-out three-colour process, which consists in spreading granules dyed with dyes of the three colours (red, yellow and blue), which will not diffuse from their proper granules with or without a binding medium, which may also be sensitised and dyed with a non-diffusing dye.—Eng. Pat., No. 20,396, 1913 "B.J.," Dec. 1, 1916, p. 652. The full text of the patent specification is published in "B.J." Colour Supplement, Dec 1, 1916, p 45.

Key to the Abbreviations of Journals quoted in "Epitome of Progress," with Addresses.

[We publish this list of journals, as in previous years, for the reason that it is practically a complete directory of the photographic journals throughout the world. But it should be mentioned that since the outbreak of war no French, Belgian, German, or Austrian photographic publications have reached us with the exception of the "Photo-Revue," which is now published monthly, and a few issues of the Vienna journal, "Photographische Korrespondenz." Ed. "B.J.A."]

"A. P." .. .. "The Amateur Photographer and Photographic News."
Hazell, Watson & Viney, Ltd., 52, Long Acre London, W.C.

"Amer. Phot." .. "American Photography."
221, Columbus Avenue, Boston, Mass., U.S.A.

"Apollo" .. .. "Apollo."
Albrechtstrasse 39b, Dresden A 10, Germany.

"Atelier" .. .. "Das Atelier."
W. Knapp, Halle a/Saale, Germany.

"Aust. Phot. Journ.".. "Harringtons' Photographic Journal."
Harringtons', Ltd., 380, George Street, Sydney, Australia.

"Aust Phot. Rev." .. "Australasian Photo-Review."
Kodak (Australasia), Ltd., 379, George Street, Sydney, Australia.

"B. J." .. .. .. "The British Journal of Photography."
Henry Greenwood & Co., Ltd., 24, Wellington Street, Strand, London, W.C.

"B.J.A." .. .. "The British Journal Photographic Almanac."
Henry Greenwood & Co., Ltd., 24, Wellington Street, Strand, London, W.C.

"Bull. Belge".. .. "Bulletin de l'Association Belge de Photographie."
Ch. Puttemans, Palais du Midi, Brussels.

"Bull. Soc. Fr. Phot." "Bulletin de la Société Française de Photographie."
Gauthier-Villars, Quai des Grands-Augustins, 55, Paris, France.

"Bull. Phot." .. .. "Bulletin of Photography."
210-212, North 13th Street, Philadelphia, U.S.A.

"Cam." .. .. "The Camera."
210-212, North 13th Street, Philadelphia, U.S.A.

"Cam. Craft" .. .. "Camera Craft."
413/415, Call Building, San Francisco, Cal., U.S.A.; and 3, Wine Office Court, Fleet Street, London, England.

"Cam. Work" .. .. "Camera Work."
Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.

"Chem News" .. "The Chemical News."
E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.

"Chem. Zeit." .. .. "Chemiker Zeitung."
Dr. G. Krause, Cöthen (Anhalt), Germany.

"D. Phot. Zeit" .. "Deutsche Photographen-Zeitung."
K. Schwier, Sophien Strasse 4, Weimar, Germany.

"Der Amateur" .. "Der Amateur."
Mondscheingasse 6, Vienna VII, Austria.

"Der Phot." .. .. "Der Photograph."
L. Fernbach, Bunzlau.

"Eder's Jahrbuch" .. "Jahrbuch für Photographie und Reproduktionstechnik."
W. Knapp, Halle a/S., Germany.

"Il Prog. Foto." .. "Il Progresso Fotografico."
R. Namias, Parco Mirabello Milan, Italy. R.

"Il Corr. Foto" .. "Il Corriere Fotografico."
12, Via le Magenta, Milan, Italy.

"Journ. Phot. Soc. Ind." "Journal of the Photographic Society of India."
40, Chowringhee, Calcutta, India.

"Journ. Roy. Micr. Soc." "Journal of the Royal Microscopical Society."
Williams & Norgate, 14, Henrietta Street, London, W.C.

"Journ. S. C. I." .. "Journal of the Society of Chemical Industry."
Vacher & Sons, Ltd., Westminster House Great Smith Street, London, S.W.

"Journ. Soc. Arts" .. "Journal of the Royal Society of Arts."
G. Bell & Sons, Ltd., York House, Portugal Street, London, W.C.

"Knowledge" .. .. "Knowledge."
Knowledge Publishing Co., Ltd., 42, Bloomsbury Square, London, W.C.

"Le Phot." .. .. "Le Photo Journal."
23, Rue Varenna, Paris.

"Mon. Phot." .. .. "Le Moniteur de la Photographie"
17, Rue des Moines, Paris, France.

"Nature" .. .. "Nature."
Macmillan & Co., Ltd., St. Martin's Street, London, W.C.

"Oest. Phot. Zeit." .. "Oesterreichische Photographen Zeitung."
Oesterreicher Photographen-Verein, Vienna III/I.

"Opt." .. .. .. "The Optician"
Gutenberg Press, Ltd, 123, 124 & 125, Fleet Street, London, E.C.

"P.M." .. .. "The Photo-Miniature."
103, Park Avenue, New York, U.S.A.

"Pharm. Journ." .. "The Pharmaceutical Journal."
72, Great Russell Street, London, W.C.

"Phil. Mag" .. .. "The Philosophical Magazine."
Taylor & Francis, 7½, Red Lion Court, Fleet Street, London, E.C.

"Phil. Trans." .. "Philosophical Transactions of the Royal Society."
Harrison & Sons, 45, St. Martin's Lane, London, W.C.

"Phot." .. .. "Photography and Focus."
Iliffe & Sons, Ltd., 20, Tudor Street, London E.C.

"Phot. Chron." .. "Photographische Chronik."
W. Knapp, Halle a/Saale, Germany.

"Phot. Indus." .. "Photographische Industrie."
31, Blücherstr, Berlin S 61, Germany.

"Phot. Journ." .. "Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal").
Harrison & Sons, 45, Pall Mall, London, S.W.

"Phot. Korr." .. .. "Photographische Korrespondenz."
Bäckerstrasse 6, Vienna I, Austria.

"Phot. Kunst" .. "Photographische Kunst."
Paul Heysestrasse 29/31, Munich, Germany.

"Phot. Journ. America." "Photographic Journal of America." (formerly "Wilson's Photographic Magazine")
122, East 25th Street, New York, U.S.A.

"Phot. Rund." .. "Photographische Rundschau."
19, Mühlweg, Halle a/S. Germany.

"Phot. Times" .. "The Photographic Times."
135, West Fourteenth Street, New York, U.S.A.

"Phot. Welt" .. "Photographische Welt."
(M. Eger), 4, Gabelsbergerstrasse, Leipsic, Germany.

"Phot Woch." .. "Photographisches Wochenblatt."
13A, Genthiner Strasse, Berlin W.

"Photo-Era" .. .. "Photo-Era."
383, Boylston Street, Boston, Mass., U.S.A.

"Photo Gazette" .. "Le Photo Gazette."
1, Rue de Médecis, Paris, France.

"Photo-Revue" .. "Photo-Revue."
118, Rue d'Assas, Paris VI, France.

"Photo-Woche"	..	"Photo-Woche." 6, Lietzensee Ufer, Charlottenburg, Berlin.
"Photographie"	..	"La Photographie." 118, Rue d'Assas, Paris, France.
"Phys. Rev." ..	..	"The Physical Review." 41, North Queen Street, Lancaster, Pa., U.S.A.
"Procédé" ..	..	"Le Procédé." 150, Boulevard de Montparnasse, Paris XIV.
"Rev. Trimest."	..	"Revue des Travaux de Recherches." A. Lumière et ses Fils, Lyons.
"Sci. Amer." ..	..	"The Scientific American." Munn & Co., Inc., 361, Broadway, New York U.S.A.
"Sonne" ..	..	"Sonne." Kaiser-Platz, 18, Wilmersdorf, Berlin.
"Wiener F. Phot. Zeit."		"Wiener Freie Photographen Zeitung." Gustav Walter, Alserstrasse 71, Vienna VIII, Austria.
"Wien. Mitt."..	..	"Wiener Mitteilungen." Graben 31, Vienna I, Austria.
"Zeit. für Instr."	..	"Zeitschrift für Instrumentenkunde." Julius Springer, Berlin.
"Zeit. für Repro."	..	"Zeitschrift für Reproduktionstechnik." W. Knapp, Halle a/Saale, Germany.
"Zeit. für Wiss. Phot."		"Zeitschrift für Wissenschaftliche Photographie." J. A. Barth, 16, Dörrienstrasse, Leipsic, Germany.

FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

ORTHOCHROMATIC PROCESSES.

Colour Sensitisers for Gelatine and Collodion Plates.

The following are the official instructions issued by Ilford, Ltd., for the dyes "Sensitol Red" and "Sensitol Green," issued by them and replacing respectively pinacyanol and pinaverdol.

Sensitising for Red.

"Sensitol Red" is a pure crystalline substance having the property of strongly sensitising photographic plates and collodion emulsion for red, orange and bright (yellowish) green. As it sensitises but feebly for blue-green, it is a simple matter to work plates bathed with this dye by the light of a safe-lamp emitting only bluish-green light (between λ 50—52), but no other light is permissible.

Stock Solution.—Dissolve 1 gm. of the Sensitol Red in 100 c.c.s. (3½ ozs.) of warm alcohol or industrial spirit, and dilute with alcohol up to 1000 c.c.s. (35 ozs.). Stored in the dark this solution keeps indefinitely

To make red-sensitive plates, select a brand of ordinary gelatine plates, which do not veil readily, and bathe for 2 or 3 minutes in the dark in the following solution :—

Water	.. ..	7 fl. oz.	=	200 c.c.s.
Stock Sensitol Red solution (1:1000)		50 minims	=	3 c.c.s.

Wash well in running water, or frequent changes for several minutes, and dry as quickly as possible in a current of warm, dry air free from dust in total darkness.

Washing of the plates may be omitted, and more rapid drying effected if the plates are bathed in an alcoholic bath such as:—

Distilled water	18 ozs.	=	500 c.c.s.
Industrial Spirit	9 ozs.	=	250 c.c.s.
Stock Sensitol Red solution ..	170 minims	=	10 c.c.s.

Soak for 3 or 4 minutes, dry without washing.

This bath keeps in good condition much longer than the water-bath, and after use or prolonged standing may be restored to full vigour with a little stock dye solution.

Water bathing usually gives the highest colour sensitiveness and utmost freedom from veil; the spirit bath is easier to work, and gives less liability to local defects due to dirt or impurities in the emulsion.

To sensitise Collodion Emulsion.—

Add 1 part of the stock dye solution (1 : 1,000) to every 100 to 200 parts of emulsion. The sensitised emulsion keeps well.

Sensitising for Green.

"Sensitol Green" confers great sensitiveness to the whole of the blue-green, yellow-green, and yellow of the spectrum, and extends its action well into the orange-red.

Silver bromide bathed with "Sensitol Green" is, however, practically insensitive to deep red, and hence a deep ruby safe-light may be used in handling the sensitised plates or emulsion.

The dye as supplied is exceptionally pure and highly crystalline, and has no tendency to produce chemical fog in clean-working emulsions.

Stock Solution.—Dissolve 1 gm. "Sensitol Green" in sufficient hot alcohol or industrial spirit (about 250 c.c.s.) and make up to 1000 c.c.s. with cold alcohol or industrial spirit. This solution keeps indefinitely if stored in the dark.

The aqueous dye bath is as follows:—

Distilled water..	1,000 c.c.s.		35 ozs.
Stock Sensitol Green solution	15 to 20 c.c.s.	-	4 to 6 drams.

Bathe for 3 or 4 minutes, then wash in running water or frequent changes for several minutes before draining. Dry rapidly in a current of warm, dry air free from dust.

The alcoholic dye bath is:—

Distilled water..	1,000 c.c.s.	-	35 ozs.
Industrial spirit	500 c.c.s.	=	17½ ozs.
Stock Sensitol Green solution ..	30 c.c.s.	=	1 oz.

Bathe for 3 or 4 minutes. Do not wash before drying.

Aqueous dye baths gradually deteriorate on keeping, while alcohollc baths do not, unless exposed to light.

For collodion emulsion, add 85 c.c.s. (or 3 ozs.) of the above stock dye solution to every 1,000 c.c.s. (or 35 ozs.) of the emulsion.

Sensitising for Red and Green.

If it is desired to produce high red and green sensitiveness in the same plate, "Sensitol Red" and "Sensitol Green" should be used in conjunction.

Practical Notes on Bathing.

The dye solution is prepared in a measure, the plates are dusted and laid in a flat porcelain dish, which is large enough to hold nearly twice the number of plates it is desired to sensitise at one time. These are put at one end of the dish; the dish is then tilted, and the dye solution poured into the other (empty) end, then the dish is tilted back, so that the dye solution sweeps over the plates in one even flow free from air bells. The dish is now gently rocked for three minutes, then the plates are removed and washed in a good stream of running water for at least another three minutes. Their sensitiveness and keeping quality will probably be somewhat greater if they are washed for ten minutes, but they will remain good for months, kept under proper conditions, after three minutes' thorough washing.

The water tap should be fitted with one of the small anti-splash filters, the fine wire gauze in which retains any solid particles that may be in the water.

After washing, the plate should be well swabbed with a wad of cotton wool, and then placed in a drying cupboard. The quicker drying takes place the better, so that if a current of warmed, filtered air, free from fumes, can be sent through the cupboard it is an advantage, though the absence of this convenience need not deter anyone from sensitising plates. Drying can be hastened by placing a dish containing a pound or two of dry calcium chloride or quicklime at the top of the cupboard.

Safe-lights for Developing.

The dyes hitherto in most general use for the preparation of safe-lights and the quantities of each for a unit area are as follows:—

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	1/10
Or brilliant yellow	0·5 mgm.	1/20
Or naphthol yellow	1 mgm.	1/10 gm.
Or auramine	2 mgm.	1/5 gm.

Red safe light for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{5}$
Rose bengal (or fast red) ..	0·5 mgm.	$\frac{1}{20}$

Safe light for Ortho plates.

The above screen is combined with one containing—

Methyl violet	0·5 mgm.	$\frac{1}{20}$

The red screen transmits light from the end of the visible red about λ 7,000 to λ 5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500.

The dyes are dissolved in gelatine solution, which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c.c.s. should be allowed for every 100 sq. cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

DEVELOPERS AND DEVELOPMENT.

In this section we give developers for plates, roll and cut films arranged in alphabetical order.

PROPERTIES OF CHEMICALS IN COMMON USE.

Soda sulphite should be in clear crystals. It should be kept well corked, otherwise the crystals become dull and powdery. Such sulphite must be rinsed for a few seconds, in a measure, with enough cold water to cover it, the water poured away and the crystals dried on a clean cloth and weighed out. Warm water, not hot or cold, is the best to use. The ordinary form of sulphite (to be used in all formulæ in this book unless otherwise directed) is the "cryst." The "anhydrous" is a stronger variety, 1 part of which is equivalent to about 2 parts of "cryst."

Potass. metabisulphite should be in flattish crystals, with only a little powdery coating on them. Both dry and in solution it keeps

much better than sulphite, and goes much further as a preservative. It should be well corked.

It should not be dissolved in hot water. Metabisulphite is an acid substance, every grain neutralising 1 grain of soda carbonate cryst., ½ grain of caustic potash, ⅓ grain caustic soda, or $\frac{3}{10}$ grain dry potass. carbonate.

Soda carbonate, cryst., is best purchased from a photographic dealer; washing soda ("sal soda" in the U S.) is a more or less impure form. The salt loses water in the air, becoming thereby somewhat stronger, and should therefore be kept well corked.

Potass. carbonate should be purchased "dry" and be most securely corked; it absorbs moisture greedily, and if it has been kept for any time should be dried in the oven before weighing out.

Caustic potash.—Purchase as "best stick pure" and keep well corked. Weigh out quickly and handle as little as possible, as it corrodes the skin.

Caustic soda resembles caustic potash, and the same remarks apply.

Note.—In all formulæ the metric weights are not equivalents of the British item for item, but each formula gives a solution of the same composition.

The following are a few of the typical formulæ generally employed for development, etc.:—

Amidol.

(*Diamidophenol, made in Great Britain as Amidol-Johnson's*)

A normal developer consists of:—

Amidol	2—3 grs.	4 5—7 gms.
Sodium sulphite	25 grs.	57·5 gms.
Water to	1 oz.	1,000 c.c.s.

The mixed developer will keep well in solution for about a week, or sometimes longer, if it is made *not stronger* than given above. It must be made up with freshly dissolved sulphite, as this salt does not keep well in solution for more than a few weeks. A sodium sulphite solution that has had added to it some potassium metabisulphite will, however, keep well for a very long period, and by the addition of dry amidol a fresh developer can be rapidly prepared when required. Make the following stock neutralised sulphite solution:—

NEUTRAL STOCK SULPHITE.

Sodium sulphite	4 ozs.	200 gms.
Potassium metabisulphite ..	½ oz.	25 gms.
Water to	20 ozs.	1,000 c.c.s.

It is *best* to boil this mixture after having dissolved the chemicals in moderately hot water. Boiling is not essential, but it improves the keeping qualities of the solution.

DEVELOPER.

Amidol	40—60 grs.	2—3 grs.	4 5—7 gms.
Stock sulphite sol.	4 ozs.	100 minims	200 c.c s.
Water to	20 ozs.	1 oz.	1,000 c.c.s.

Amidol is an excellent non-staining developer, giving detail at first and density afterwards. Suitable for plates, papers and lantern slides.

Azol.

The following are the instructions for the use of this single-solution developer :—

For Plates and Films :—

Normal exposures :	Azol	20 mins.	¼ oz
	Water ..	to 1 oz.	to 6 ozs.
Under-exposures .	Azol	15 mins	¼ oz.
	Water.. ..	to 1 oz.	to 8 ozs.
Over-exposures :	Azol	30 mins.	¼ oz.
	Water.. ..	to 1 oz.	to 4 ozs.

For stand development :—Azol, 1 oz , water 100 ozs.

For tank development: -Azol, ¾ oz. ; water 40 ozs. Time of development of films at 60 deg. F , 20 to 30 minutes. This solution may be used several times in succession.

For lantern slides and transparencies :- -Azol, 25 mins. ; potass. bromide 10%, 5 mins., water to 1 oz

For bromide papers :—Azol, 15 mins. ; water to 1 oz. A few drops of 10% solution potass. bromide may be added if the whites are grey.

For gaslight papers :- -Azol, 40 mins. water to 1 oz. Add a few drops of 10% solution of potass. bromide sufficient to keep the whites clear.

Diamidophenol.

See Amidol.

Ferrous Oxalate.

This developer is rarely used now . it calls for greater exposure o the plate. But it is unique in the perfectly clear grey stainless negatives which it yields.

A.—Potass. oxalate (neutral), 5 ozs ; hot water, 20 ozs. Cool, and pour off clear liquid for use.

B.—Warm water, 20 ozs. ; sulphuric acid, 30 minims ; sulphate of iron, 5 ozs.

Mix 1 oz. of B. with 3 to 4 ozs of A (pouring B into A, not *vice versâ*).

A more powerful developer is made by dissolving commercial dry ferrous oxalate in boiling saturated solution of potassium oxalate. As much as will dissolve is stirred in, and the whole left to cool, after which the clear solution is poured off for use.

Hydroquinone.

Made up with soda carbonate (as per the first formula below) hydroquinone is a rather slow-acting developer. The caustic-soda formula is quicker but easily gives excessive density and contrast; it is best suited for line drawings or subjects where full contrast is required.

ONE-SOLUTION

Hydroquinone	100 grs.	11·5 gms.
Sodium sulphite	$1\frac{1}{2}$ ozs.	75 gms.
Sodium carbonate..	3 ozs.	150 gms.
Water to....	20 ozs.	1,000 c c.s.

May be diluted with an equal volume of water.

This formula is not so quick in action as the next one, but there is less tendency for the great density in the high-lights which is easily produced in cases of under-exposure. In all cases the temperature of the hydroquinone developer should not be allowed to fall below 60 deg., or the solution becomes inert.

TWO SOLUTION (CAUSTIC SODA).

A.—Hydroquinone	160 grs.	18 gms.
Sodium sulphite	2 ozs.	100 gms.
Citric acid	60 grs.	7 gms.
Potass. bromide	40 grs.	4·5 gms.
Water to	20 ozs.	1,000 c c.s.
B.—Caustic soda (stick)	160 grs.	18 gms.
Water to	20 ozs.	1,000 c.c.s.

For use:—A, 1 oz.; B, 1 oz.; water, 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	130 grs.	15 gms.
Sodium sulphite	6 ozs.	300 gms.
Formaline	3 drs.	20 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

A slow developer, giving great clearness in the shadows and plenty of density in high-lights, and specially suitable for line-subjects.

Monomet.

(British made developer of White Band Manufacturing Co.)

(FOR SOFT NEGATIVES.)

Monomet	20 grs.	2·2 gms.
Soda sulphite, cryst.	240 grs.	28 gms.
„ carbonate, cryst.	240 grs.	28 gms.
Potass bromide 10 % solution ..	20 to 40 minims	2 to 4 c.c.s.
Water	20 ozs.	1,000 c.c.s.

This may be made up in bulk as follows:—Monomet, 80 grs.; soda sulphite, cryst., 2 ozs.; soda carbonate, cryst., 2 ozs.; potass. bromide, 1 to 2 drams, water, 80 ozs.

For use with plates and films, 1 part of the stock solution is mixed with 1 part of water to form the working developer.

Monomet-Hydroquinone.

Monomet	16 grs.	2 gms.
Hydroquinone	32 grs.	4 gms.
Sodium sulphite, cryst.	240 grs.	28 gms.
Soda carbonate, cryst.	240 grs.	28 gms.
Potass. bromide 10% solution ..	20 minims	2 to 4 c.c.s
Water	20 ozs.	1,000 c.c.s.

For use in bulk the formula may be made up as follows:—Monomet, 64 grs.; hydroquinone, 120 grs.; soda sulphite cryst., 2 ozs.; soda carbonate, cryst., 2 ozs.; potass. bromide, 1 dram; water, 80 ozs.

For negative one part of this stock solution is mixed with one part of water to form the working developer.

Formula for Tank Development.

Monomet	3½ grs.	0·4 gm
Hydroquinone	9 grs.	1·2 gm.
Soda sulphite, cryst ..	¾ oz.	40 gms.
Soda carbonate, cryst. .. .	70 grs.	8 gms.
Potass. bromide 10% solution ..	5 drops	0·6 c.c.
Water	20 ozs.	1,000 c.c.s.

With this formula development is complete in about 20 minutes.

Monomet-Pyro.

A.—Monomet	20 grs.	2·2 gms.
Pyrogallic acid	40 grs.	4·5 gms.
Potass. metabisulphite .	100 grs.	10 gms.
Water	20 ozs.	1,000 c.c.s.
B.—Soda carbonate	800 grs.	90 gms.
Potass. bromide . .	16 grs.	2 gms.
Water	20 ozs.	1,000 c.c.s.

Equal parts of A and B are mixed to form the working developer.

Paramidophenol.

ONE-SOLUTION.

Potassium metabisulphite ..	6 ozs.	300 gms.
Distilled water (boiling)	20 ozs.	1,000 c.c.s.
Paramidophenol	2 ozs.	100 gms.

Dissolve quickly in the above order and add gradually—

Caustic soda or potash .. .. q.s.

to dissolve the precipitate first formed.

For use, dilute 1 oz. with from 10–30 ounces of water.

Paramidophenol is stainless and keeps well in single solution, owing probably to its preservative action on soda sulphite.

TWO-SOLUTION.

A.—Paramidophenol hydrochloride ..		200 grs.	23 gms.
Potassium metabisulphite	..	100 grs.	11·5 gms.
Distilled water to..	.. ..	20 ozs.	1,000 c.c.s.
B.—Sodium sulphite ..	.. ..	1¼ oz	62·5 gms.
Potassium carbonate	.. ..	1¼ oz.	62·5 gms.
Distilled water to..	.. ..	20 ozs.	1,000 c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

Pyro-Soda Developer.

(The "B.J." Formula.)

Make up two solutions according to the following formula—

A.—Pyro	.. ..	1 oz.	50 gms
Soda sulphite, cryst...	.. ..	8 ozs	400 gms.
or anhydrous	.. .. ..	4 ozs.	200 gms.
Potass. metabisulphite	.. ..	1 oz	50 gms.
Water ..	.. ..	60 ozs.	3,000 c.c.s.
B.—Soda carbonate, cryst.	.. ..	12 ozs.	600 gms.
or anhydrous	.. .. ..	4½ ozs.	225 gms
Water ..	.. ..	60 ozs.	3,000 c.c.s.

Mix A, 1 part ; B, 1 part , water, 2 parts.

In making the A solution the sulphite and metabisulphite should be mixed together dry and put together into hot water. When they are dissolved, the solution should preferably be brought to the boil and boiled for about a minute, after which the pyro is dissolved—when the solution is cooled. The boiling greatly improves the keeping qualities of the solution.

If preferred the sulphite and metabisulphite can be dissolved in only half the water and the necessity of heating or boiling so much solution thus avoided. The second half can be added cold and the pyro then dissolved.

This developer will produce negatives free from pyro stain, and [illegible] to 6 minutes' development at normal temperature with full exposure will yield soft negatives full of detail and well suited to enlarging. The advantages of the developer are its cleanliness and the extraordinary keeping qualities of the A solution which must be made up as directed above.

When stronger negatives are required the developer can be made up by taking equal parts of A, of B, and of water, or equal parts of A and [illegible] alone can be used, this giving a developer containing about [illegible] grains pyro to the ounce.

The mixed solution can be used for several plates in succession if a little extra time is given for development in each case.

Ordinary Formula.

The following is a formula for the pyro-soda developer on the [illegible] recommended by most of the British plate makers, *i.e.*, with metabisulphite only as the preservative of the pyro in the A solution,

with sulphite in the B solution in amount generally equal to that of the soda carbonate therein :—

A.—Potass. metabisulphite	.. ..	30 grs.	3·5 gms.
Water..	.. ..	20 ozs.	1,000 c.c.s.
Pyro ..	.. ..	½ oz.	12 5 gms.
B.—Soda carbonate, cryst	. ..	2 ozs.	100 gms.
Soda sulphite, cryst.	.. ..	2 ozs	100 gms.
Potass. bromide	.. .	10 grs.	1 gm.
Water..	.. ..	20 ozs.	1,000 c.c.s.

Mix equal parts of A and B

The Hurter and Driffield standard pyro-soda developer for plate speed testing is :—

Pyro	.. ..	8 parts
Sodium carbonate	.. ..	40 parts.
Sodium sulphite ..	.. ..	40 parts.
Water to ..	.. ..	1,000 parts.

Pyro-Ammonia.

(10% SOLUTIONS.)

A.—Pyro	.. ..	1 oz	100 gms.
Potass. metabisulphite* ..	..	1 oz.	100 gms.
Water to make	.. . ..	9 ozs.	1,000 c.c.s.
B.—Potass. bromide	.. .. .	1 oz.	100 gms.
Distilled water to	.. ..	9 ozs	1,000 c.c.s.
C.—Liquid ammonia (0·880)..	..	1 oz. (fl.)	100 c.c.s.
Distilled water to..	.. ..	9 ozs.	1,000 c.c.s.

To make a normal developer, take A, 20 minims ; B, 10 minims ; C, 30 minims ; water to 1 oz. ; or if no bromide is used, A, 20 minims ; C, 10 minims ; to water, 1 oz. , or in metric measures, A, 2 c.c.s. ; B, 1 c.c. ; C, 3 c.c s. , water to 50 c c.s.

Pyro-Caustic Soda.

(VALENTA.)

A.—Pyro	.. ..	220 grs.	25 gms.
Soda sulphite	.. .. ..	3¼ ozs.	162·5 gms.
Water to ..	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Caustic potash	.. .. ..	100 grs.	11·5 gms.
or			
Caustic soda	.. .. ..	70 grs.	8·5 gms.
Water to ..	.. .. ..	20 ozs.	1,000 c.c.s.

Take A, 1 oz. ; B, 1 oz. ; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

*Or Soda sulphite .. .. .. 4 ozs. 400 gms.

Pyro-Scalol.

A.—Potass metabisulphite	50 grs.	5·7 gms.
Pyro	30 grs.	3·4 gms.
Scalol	20 grs.	2·3 gms.
Water	20 ozs.	1,000 c.c.s.
B.—Soda carbonate, recryst.	4 ozs.	200 gms.
or anhydrous	$1\frac{1}{2}$ ozs.	75 gms.
Soda sulphite, recryst.	1 oz.	50 gms.
or anhydrous	$\frac{1}{2}$ oz.	25 gms.
Water (warm)	20 ozs.	1,000 c.c.s.

The chemicals are dissolved in warm water in the order named; the solution is ready for use when cold.

To mix the working developer take equal parts of A and B.

Pyro-Acetone.

A.—Pyro	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 gms.
Distilled water to	9 ozs.	1,000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised, and there should be no addition of citric acid.

A normal developer consists of:—

A. sol (= pyro, 4 grs. or 8 gms.)	40 minims	80 c.c.s.
Acetone	40 minims	80 c.c.s.
Water	1 oz.	1,000 c.c.s.

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

Pyrocatechin.

TWO-SOLUTION.

A.—Pyrocatechin	175 grs.	20 gms.
Sodium sulphite	$1\frac{1}{2}$ oz.	75 gms.
Water	20 ozs.	1,000 c.c.s.
B.—Potass. carbonate	$2\frac{1}{2}$ ozs.	125 gms.
Water	20 oz.	1,000 c.c.s.

Equal parts are mixed together.

ONE-SOLUTION.

Sodium sulphite	5 ozs.	250 gms.
Water	20 ozs.	1,000 c.c.s.
Caustic soda	260 to 300 grs.	30 to 34·5 gms.
Pyrocatechin	400 grs.	46 gms.

The chemicals are dissolved in this order, and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

Scalol.

British-Made-Developer (Johnson's).

Soda sulphite, recryst.	½ oz.	25 gms.
or anhydrous	110 grs.	12 5 gms.
Scalol	20 grs	2·3 gms.
Soda carbonate, recryst ..	1 oz.	50 gms.
or anhydrous	168 grs.	19 gms.
Potass. bromide	4 grs	0 5 gm.
Water, warm	20 ozs	1,000 c.c s.

Dissolve the chemicals in warm water in the order named; the developer is ready for use when cold.

This solution is suitable for use with plates, films, or papers

Scalol-Hydroquinone.

ONE-SOLUTION.

Soda sulphite, recryst .. .	1 oz	50 gms.
or anhydrous	½ oz.	25 gms.
Scalol..	20 grs.	2·5 gms.
Hydroquinone	40 grs	4·5 gms.
Soda carbonate, recryst ..	1½ ozs	75 gms
or anhydrous	250 grs	28 gms
Potass. bromide	5 grs.	0 5 gm
Water (warm)	20 ozs.	1,000 c.c.s.

Dissolve the chemicals in warm water in the order named and use when the solution is cold.

All descriptions of work, negatives on plates and films, and bromide and gaslight papers, the above stock solution is mixed with an equal bulk of water

Factorial Development.

The total time of development (found by trial to give a certain amount of contrast) divided by the time in which the image first appears is the "factor" of a developer.

The following "Watkins' factors" are abstracted from the instructions from the "Watkins' dark room clock and factoria calculator":—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Factor.		Grs. pyro to oz.	Grs. brom. to oz.	Factor.
Pyro-soda without bromide	1	18	Pyro-soda with bromide	1	¼	9
	2	12		2	½	5
	3	10		3	¾	4½
	4	8		4	1	4
	5	6½		8	2	3½

Pyro-acetone—about double the above figures

	Factor.
Amidol (2 grs. per oz.) ..	18
Diamidophenol	60
Diogen	12
Hydroquinone (minimum bromide)	5
Hydroquinone (maximum bromide)	4½
Ilford pyro-soda (maximum pyro)	4½
Ilford pyro-soda (minimum pyro)	5½
Imperial pyro-soda ..	4¾
Imperial Standard (pyro-metol)	9
Kodak powders	18
M.Q.	14
Pyrocatechin	10
Quinomet	30

Note.—High-factor developers (*e.g.*, diamidophenol and Azol), owing to the long time which is needed for density, tend to softness. Short-factor developers (*e.g*, hydroquinone and strong pyro-soda) tend to hardness, as they quickly build up density after the image appears.

Where a factor divides evenly into 60, the product is called a divisor, and will greatly facilitate calculating the total time of development. Thus Diogen has a divisor of 12 (60 divided by 5), and if the time of appearance in *seconds* is divided by 12 the result is the number of *minutes* to develop.

PYRO-SODA DEVELOPERS.

With and without bromide.

	Factor.
Austin-Edwards (with B) ..	5
Barnet (with B)	4¾
Cadett (no B)	9
Kodak (no B)	12
Edwards (with B)	4½
Premier (with B)	4½
Gem (with B)	4
Marion (with B)	4½
Mawson (no B)	10
Paget (no B).. . ..	11
Thomas (with B)	5
Wratton (no B)	11
Wellington (normal) ..	11
Wellington (studio) ..	15

Restrainers.

Potassium bromide in 10 per cent. solution is the most common restrainer. The dose is from one half-grain (5 minims) per ounce of developer.

Ammonium citrate solution has the advantage that after it has been added to the developer density can be obtained without further fogging, though the development of detail is prevented. An average dose with the pyro-ammonia developer is 6 to 10 grains per ounce (60 to 100 minims of solution made by adding ammonia, about 250 minims, to 1 ounce of citric acid dissolved in a little water until neutral, and diluting the whole to 10 ounces).

Potassium borotartrate.—10 to 30 minims of a 10 per cent. solution restrain with most developers.

Sodium bicarbonate acts as a restrainer, particularly with amidol developer.

FIXING, & HYPO ELIMINATORS.

The Hypo Fixing Bath.

In making up the fixing bath cold water should not be used: the hypo greatly chills the water as it dissolves, and hinders the process. There is no harm in using even very hot water if the bath is cold before use.

The average strength of hypo for fixing negatives is 4 ozs. per 20 ozs. It should not be less, but may be more -5, 6 or 8 ozs.

A convenient method of keeping hypo is dissolve each pound in about a pint of water (hot), cool and make up to 32 ozs. in all. Every 2 ozs. of this stock solution equals 1 oz hypo. It is used as follows to make up baths of various strength

Hypo, required per 20 ozs. of fixing bath.		Mix, of stock solution,		Water.	
8 ozs.	..	16	with	[illegible]	i.e., stock, 4; water, 1.
6 ozs.	..	12	with	8	i.e., stock, 3; water, 2
5 ozs.	..	10	with	10	i.e., equal parts.
4 ozs.	..	8	with	12	i.e., stock, 2, water, 3.
3 ozs.	..	6	with	14	i.e., stock, 3; water, 7.
2 ozs.	..	4	with	16	i.e., stock, 1; water, 4.

In fixing plates, observe three golden rules. -

1.—Let plates remain in fixer as long again as it takes for the white emulsion to dissolve away.

2.—Always rinse fingers under tap or in a dish of water after touching hypo, not simply wipe on a towel.

3.—Avoid letting hypo droppings dry up on table or floor. If hypo solution drops or is splashed or spilt about the dark room, mop it up with a floor cloth and leave all clean.

Acid Fixing Baths.

Hypo	4 to 6 ozs.	200 to 300 gms.
Potass. metabisulphite	½ oz.	25 gms.
Water	20 ozs.	1,000 c.c.s.

The metabisulphite should be added only when the hypo solution is cool or tepid—not when it is hot.

This is the best formula we know for an acid fixing bath for plates or papers. It keeps clear and stainless to the last, and does not throw down sulphur with use.

The following is a cheaper bath.—

Hypo solution (1 : 5)	50 ozs.	1,000 c.c.s.

To which add a mixture of—

Tartaric acid solution (1 : 2) ..	1½ oz	30 c.c.s.
Sodium sulphite solution (1 : 4)	3½ ozs.	70 c.c.s.

Alum-Hypo Fixing Bath.

Alum (saturated solution)	20 ozs.	1,000 c.c.s.
Sodium sulphite (saturated solution)	4—7 ozs.	200-300 c.c.s.
Hypo-solution (1:5)	20—28 ozs.	1,000-1,250 c.c.s.

Chrome Alum and Hypo Fixing Bath.

Add—

Strong sulphuric acid	2 dr. (fl.)	10 c.c.s.
Water	2 ozs.	80 c.c.s.

to—

Sodium sulphite	2 ozs.	80 gms.
Water	6 ozs.	240 c.c.s.

And pour the mixture into—

Hypo	16 ozs.	700 gms.
Water	48 ozs.	2,000 c.c.s.

Finally add to the above mixture—

Chrome alum	1 oz.	40 gms.
Water	8 ozs.	300 c.c.s.

Removing Hypo by Washing.

In washing negatives in running water or frequent changes, over 90 per cent. of the hypo is cleared away in less than ten minutes. To remove the remainder by a washer or hand method, it is essential to drain off *all* the water in which the negative has soaked. The best washers are those which alternately empty and refill, and the same principle should be followed when washing in dishes. If this is done there is no need to wash negatives longer than an hour at the outside.

Hypo-eliminators are chemicals which convert the hypo into some other substance, but as it is not certain into what, this chemical method of removing hypo is not so reliable as removal by washing. But we give three formulæ.

Hypo-Eliminators.

PERMANGANATE.

Wash the negative for one minute under the tap, and transfer to a shallow dish containing water with enough potass. permanganate in it to turn it pink. Remove the negative as soon as the colour goes (which will be in a second or two if hypo is present), and keep on treating in the very weak permanganate baths until the colour is not discharged. The water itself will destroy the permanganate colour, but not quickly as hypo does. A very cheap and satisfactory process which allows of a negative being ready for drying within three minutes of fixation.

PERSULPHATE.

Ammonium persulphate	2½ grs.	6 gms.
Carbonate of soda..	5 grs.	12 gms.
Water	1 oz.	1,000 c.c.s.

PERCARBONATE.

Potassium percarbonate	2½ grs.	6 gms.
Water	1 oz.	1,000 c.c.s.

Rapid Drying of Negatives.

Method I.—Rinse from the hypo-bath, place in 1 : 50 formaline for ten minutes, wash by pouring nearly boiling water six times over the negative and dry by heat. To get rid of the relief which is produced **by this process** the negative is rubbed with a piece of wash-leather **moistened with alcohol.**

Method II.—After washing in the usual way or using a hypo-**eliminator, lay a piece of** old fine cambric on the negative and firmly **pass a roller squeegee over it.** The negative, with much of the water **thus removed, will dry in a few minutes** in a moderately warm place.

Method III.—Soak in two successive baths of methylated spirit, **and place in a current of** air. The present commercial spirit, owing **to the mineral naphtha** in it, causes a whitish scum on the surface of **the film, and is** *not favourable* to clean work.

Method IV.—Electric hot blast by means of a blower of the kind **used by hairdressers,** and capable of giving a temperature of from **68° to 125° F.,** within from 4 to 6 minutes, according to the distance **of the blower** from the rack of negatives 3 ft. to 1 ft.

HARDENING AND CLEARING SOLUTIONS.

As a general rule, there is no need to use a method of hardening; frilling or **softening** of the films of plates is seldom met with—that is, in **temperate** latitudes. When it does occur it is most usually the **result of** baths (developing, fixing, clearing, etc.) of different strengths **or at** *different* temperatures.

If a plate *should* show signs of frilling in the developer, it should **be rinsed** for an instant and placed in one of the hardening baths, **given below, then** washed for ten minutes before fixing. This is better **than hardening** *after* fixing.

Hardening Baths.

Formaline	1 oz. fluid.	50 c.c.s
Water	10 to 20 ozs.	500–1,000 c.c.s.
Alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Chrome alum	1 oz.	50 gms
Water	20 ozs	1,000 c.c.s.

Whichever bath is used, allow it to act for 15 or 20 minutes.

In making up the chrome alum bath, use cold or warm, not hot, **water.**

Clearing Solutions.

Acid Alum.

Alum	2 ozs.	200 gms.
Citric acid	1 oz.	100 gms.
Water	10 ozs.	1,000 c.c.s.

Wash well after fixing, and immerse the negative in the above This bath is also useful for removing white scum from negatives developed with ferrous oxalate if rubbed on with cotton wool.

Chrome Alum.

Chrome alum	½ oz.	25 gms.
Hydrochloric acid..	½ oz	25 c.c.s.
or		
Citric acid	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

We prefer this latter bath for the final treatment of negatives, and for obtaining a clean smooth film.

Thiocarbamide.

Thiocarbamide	90 grs.	10 gms.
Citric acid	90 grs	10 gms.
Water	20 ozs.	1,000 c.c.s.

Sodium Hypochlorite.

(Eau de Javelle.)

This bath need only be resorted to in cases of severe stain, particularly on old negatives

Bleaching powder..	1 oz.	30 gms.
Sodium carbonate..	1½ oz.	45 gms.

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s), and filter. Extract the residue with plain water, and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

N.B. -In either state (alkaline or acid) the solution has a strong softening action on gelatine. Plates should not be left to soak longer than necessary—which should be 10 to 15 minutes as a rule.

Removing Silver Stains.

Most silver stains (due to dampness of paper or negative while the two are in contact) will readily yield to the following simple treatment first suggested by Mr. Harold Baker :—

Rub the dry negative with Globe metal polish (or other similar abrading preparation) for a minute or two. This is done by applying the polishing paste on a tuft of cotton wool. Then place negative in very strong hypo solution. Here the stain disappears : the time may be minutes or hours according to the depth and age of the stain.

In very severe cases the following method may be necessary :—

Soak the negative in—

A.—Potass. iodide	.. .. ..	200 grs.	45 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

and after washing transfer to—

B.—Potass. cyanide	.. .. ..	300 grs.	70 gms.
Water	.. ..	10 ozs.	1,000 c c s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment a solution of iodine (in potass. iodide) may be used in place of solution A.

NEGATIVE INTENSIFIERS.

Negatives which are too thin (and as a rule yield flat prints) may be greatly improved by intensification.

If the negative is thin through under-exposure, that is, has not attained good density even on long development, the best intensifier is the uranium. For this, as for most intensifiers, the plate should be both thoroughly fixed and washed—one is as important as the other.

If the plate is simply under-developed—clear and bright, but thin—the chromium or the mercury and ferrous oxalate intensifier (applied more than once if necessary) or the Wellington silver intensifier is very suitable. If the plate is over-exposed, thin but veiled and flat, the mercury and ammonia intensifier is a good remedy; or it may be well first to reduce carefully with Farmer's reducer, and then (after a second thorough wash) to intensify with chromium, mercury and ferrous oxalate, Wellington, or, if plate is very flat, with Monckhoven's or the mercury and ammonia formula. The copper and lead intensifiers give great density, and are suited only for negatives of line drawings, etc., in which great general opacity and, at the same time, great clearness of the lines are required.

Mercury Intensification.

The negative is bleached in the following saturated solution of mercury bichloride :—

Mercury bichloride (corrosive sublimate)	.. .. ..	1 oz.	62 gms.
Hot water	.. .. ..	16 ozs.	1,000 c.c.s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid..	.. ..	30 minims	4 c.c.s.

After *well washing*, the bleached negative is blackened in one or other of the following:—

A.—Ammonia (0 880)	20 drops	20 drops
Water	1 oz.	30 c.c.s.

Gives great intensification and good black colour.

B.—Soda sulphite, 10 per cent. solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C.—An alkaline developer, such as pyro-soda, pyro-ammonia, hydroquinone Gives about double the intensification of B.

D.—Schlippe's salt	200-400 grs.	20-40 gms.
Water	20 ozs.	1,000 c.c.s.

This solution must be made fresh, and gives great intensification.

E.—Ferrous oxalate developer, made as directed under "Developers" This process can be repeated as many times as desired, and gives absolutely permanent results: it deals evenly throughout with the tones in the negative.

Monckhoven's.

A.—Bromide of potassium	10 grs.	23 gms.
Bichloride of mercury	10 grs.	23 gms.
Water	1 oz.	1,000 c.c.s.
B.—Pure cyanide of potassium ..	10 grs.	23 gms.
Nitrate of silver	10 grs.	23 gms.
Water	1 oz.	1,000 c.c.s.

The silver and cyanide are dissolved in separate lots of water, and the former added to the latter until a permanent precipitate is produced The mixture is allowed to stand 15 minutes, and, after filtering, forms Solution B

Place the negative in A till it is white, then rinse and transfer it to Solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

Mercuric Iodide.

A.	Mercuric chloride	175 grs.
	Water	10 ozs.
B.	Potass. iodide	1 oz.
	Water	10 ozs.

Add the major part of the iodide (B) solution to that of the mercury, and stir well. There should remain a considerable red precipitate. Then add the remainder of the iodide solution in small doses until the solution is just clear. This forms the stock intensifier.

The solution changes the negative to a brown colour which on washing in water changes to bright orange, yielding a very great degree of intensification. For still greater intensification and black colour, pass the negative, after washing, through a bath of soda sulphide, a few grains to the ounce.

A cheaper form of this formula can be made up by using only 270 grs. of potass iodide instead of 440 as directed above. This is added to the mercury solution, forming a muddy red mixture which can be cleared by adding a few drops of hypo solution.

Lumière Formula.

Water	.. ..	20 ozs.	1,000 c.c.s.
Sodium sulphite	.. .. ..	4 ozs.	200 gms.
Mercuric iodide	.. .. ..	90 grs.	10 gms

The sulphite must be dissolved first. The solution keeps well in the dark.

This is a very convenient intensifier, as plates need only be rinsed for a few minutes in water on coming out of the hypo bath to be ready for intensification.

When intensified they are simply washed for a few minutes; the negative is then liable to yellow in time, but if plate is placed for a few minutes in any non-staining developer the results are quite permanent.

If mercuric iodide is not available the following may be used:—

Mercuric chloride	.. .. ..	50 grs.	6 gms.
Water	.. ..	10 ozs.	500 c.c.s.

Add 10 per cent. potass. iodide solution until precipitate first formed is redissolved. About 1½ oz. (75 c.c.s.) will be required, and when clear, add—

Sodium sulphite	.. .. ..	4 ozs.	200 gms.
Water to make	.. .. ..	20 ozs.	1,000 c.c.s.

Silver Intensifiers.

J. B. B. WELLINGTON'S FORMULA (1911)

First harden the film in:—Formaline, 1 part, water, 10 parts. for five minutes. Rinse for a few minutes, and then place for *exactly one minute* in:—

I.—Potass. ferricyanide	.. ..	20 grs.	2·3 gms.
Potass. bromide	.. .. ..	20 grs.	2·3 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

This causes no apparent change in the negative, if used too long it will bleach the negative and alter its gradation. Rinse again for a few minutes and intensify.

Stock Solutions.

A.—Silver nitrate	.. .. ..	800 grs.	91·2 gms.
Water, distilled, to	.. ..	20 ozs.	1,000 c.c.s.
B.—Ammonium sulphocyanide	..	1,400 grs.	160 gms.
Hypo	.. ..	1,400 grs.	160 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.

Take A, ½ oz., and add slowly to ½ oz. B, stirring vigorously (mixture should be clear); then add 10 % pyro solution (preserved with sulphite), ½ dram, and 10 % ammonia solution, 3 drams.

Place negative in chemically clean dish, best of glass, and pour solution over it. Silver begins to deposit in a minute or two. When intensified enough, place in acid fixer and well wash. Flat negatives may be over-intensified and then treated with Farmer's reducer.

ACID SILVER.

A.—Pyro..	15 grs.	3·5 gms.
Citric acid	5-10 grs.	1-2 gms.
Water	10 ozs.	1,000 c.c.s.
B.—Silver nitrate	10 grs.	23 gms.
Water to	1 oz.	1,000 c.c.s.

About 1 oz. (30 c c.s) of A is poured over the plate once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed. Negatives (on gelatine plates) are best hardened with alum or formaline before using this intensifier, otherwise it is difficult to avoid stains.

Chromium Intensifier.

(*C Welborne Piper*)

An excellent and convenient intensifier for general work Results permanent.

	A.	B.	C.
Potassium bichromate ..	5 grs.	10 grs.	10 grs.
Hydrochloric acid (sp. gr., 1 160)*	1 minim	5 minims	20 minims
Water	1 oz.	1 oz.	1 oz.

Bleach in A, B or C solution, wash until yellow stain is removed, and then develop with diamidophenol.

If other developer is used, it may be necessary to expose for a short time to diffused daylight (not sunlight) during development in order to get full density Excessive exposure before development may make it difficult to obtain density.

A gives intensification about equal to mercury and ammonia; B, to that of mercury and ferrous oxalate; and C, to that of mercury and sodium sulphite.

The process may be safely applied after fixation if the plate is simply rinsed for a minute or so.

It may be repeated several times if the first application does not give enough density.

Copper Intensifier.

Gives great intensification and is best suited for line subjects.

A.—Copper sulphate	100 grs.	230 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. bromide	100 grs.	230 gms.
Water to	1 oz.	1,000 c.c.s.

* "Commercial pure" strong acid.

A and B are separately made up with hot water, mixed, and allowed to cool. The negative is bleached in the mixture, and washed for a minute or two. It is then blackened in:—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1,000 c.c.s.

For still greater density, the negative is well washed from silver, and an ordinary developer applied.

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass. cyanide (about 2 grs. per oz.).

Lead Intensifier.

Lead nitrate	400 grs.	46 gms.
Potass. ferricyanide	600 grs.	70 gms.
Acetic acid	3 drachms	20 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 per cent. nitric acid—the acid makes the film very tender—then in water, and then darkened in:—

A.—Sodium sulphide	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Or in—		
B.—Schlippe's salt	90 grs.	10 gms.
Ammonia (0 880)	6 drachms	40 c.c.s.
Water	20 ozs.	1,000 c.c.s.
Or in—		
C.—Potass. bichromate	1 oz	100 gms.
Ammonia (0 880)	½ oz.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.

The lead intensifier gives very great intensification, and is suited only for line-subjects.

Uranium Intensifier.

A.—Uranium nitrate	100 grs.	23 gms.
Water	10 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	100 grs.	23 gms.
Water	10 ozs.	1,000 c.c.s.

The intensifier is prepared from.—A sol., 1 oz.; B sol., 1 oz.; acetic acid, 2 drachms.

The plate must be perfectly free from hypo, and after intensification be washed in several changes of *still* water until the yellow stain is gone. A 10 gr. per oz. solution of ammonium sulphocyanide removes any yellow stain, and weak ammonia or sodium carbonate removes the intensification altogether, restoring the negative to its original state. A weak acetic acid bath should then be applied to the negative if the intensifier is to be again applied.

NEGATIVE REDUCERS.

Reduction is useful if the negative is so dense (black) that it takes long to print. Also, apart from reducing time of printing, reduction is used to improve the gradation of negatives.

For those which are too hard, usually as the result of under-exposure and too long development, the best reducer is the persulphate. The permanganate and bichromate are similar in their effect.

For those which, though dense, yield prints which are too flat—this is the result of great over-exposure and long development—the best is Farmer's. Belitski's is similar.

Even when density is not excessive, it is usually well, in the case of flat negatives, to reduce a little in "Farmer's," and then intensify.

The other reducers—Eder's, iodine-cyanide, and ceric sulphate—are used chiefly when it is desired somewhat to reduce negatives of good gradation.

Farmer's.

This reducer tends to remove detail in the shadows whilst leaving untouched the dense high-lights. Hence it increases contrast: "brightens up" a negative.

Hypo solution (1.5)	5 ozs.	150 c.c.s.
Potass. ferricyanide (10% sol.) ..	quant suff.	quant. suff.

The colour is a fair indication of the strength of the reducer; it should be pale yellow, not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less.

Yellow stain is due usually to the use of an acid fixing bath, or an old fixing bath, instead of clean plain hypo solution. It is not easy to remove.

If the reduction is required as "even" as possible, that is, less pronounced on the shadows of the subject in the negative, use the reducer very weak, viz: largely diluted with water.

Where the extreme of contrast is required, use a strong reducer, applying it with cotton wool, not too wet with reducer. Very useful for line negatives, where quite clear lines on a dense ground are wanted.

Belitski's.

Potass. ferric oxalate	150 grs.	10 gms.
Sodium sulphite	125 grs.	8 gms.
Water..	7 ozs.	200 c.c.s.

Dissolve and add—

Oxalic acid..	.. .. ..	40 to 45 grs.	2·6 to 3·1 gms.

and shake until the solution turns green. Then pour off from undissolved crystals and add—

Hypo	.. ..	1¾ oz.	50 gms.

Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula :—

Ferric chloride cryst.	.. ..	100 grs.	6·5 gms.
Potass. oxalate	.. .. ..	190 grs.	12·5 gms.

This reducer is stainless, and keeps well in the dark. Its action on the shadow detail of the negative is similar to that of Farmer's.

Persulphate.

Ammonium persulphate..	..	10 to 20 grs.	23 to 45 gms.
Water	.. ..	1 oz.	1,000 c.c.s.

A fresh solution is made at time of use. A drop of sulphuric acid per 2 ozs. makes the action more regular. It is best also to use the reducer before the negative has dried

When sufficiently reduced—indeed, slightly before—the negative is placed at once into 5 per cent. sodium sulphite solution.

If much reduction has taken place it is well to fix a second time. The persulphate reducer acts first on the heavy high-light densities of the negatives, reducing these without affecting shadow detail. It thus "softens" a hard negative.

Eder's (Mercury and Cyanide).

Potassium cyanide	.. ..	20 grs.	5 gms.
Potassium iodide ..	.. ..	10 grs.	2 gms.
Mercury bichloride	.. ..	10 grs.	2 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, and is non-staining and intensely poisonous.

Iodine-Cyanide.

Iodine (10 per cent. sol. in potass. iodide sol.)	.. .. ..	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)..	.. .. ..	5 minims	1 c.c.s.
Water	.. ..	1 oz.	100 c.c.s.

A very clean-acting (but intensely poisonous) reducer. Very suitable, when used quite weak, for bromide prints, as it leaves no stain.

Ceric Sulphate.

Sulphuric acid (sp. gr. 1·84)	..	20 minims	4 c.c.s.
Water	..	2 ozs.	200 c.c.s.
Dissolve in this—			
Ceric sulphate	..	1 oz.	100 gms.
And dilute to—			
Water	..	10 ozs.	1,000 c.c.s.

Hard negatives are placed wet in a mixture of this stock solution and nine times its volume of water Reduces contrasts. Over-exposed, long-developed negatives are dipped dry into a mixture of stock solution and an equal part of water and carefully watched, as the action is very rapid. A convenient form of the reducer is the stock solution sold by Lumiere.

Permanganate.

Potass. permanganate, 10% solution	..	1 dr.	10 c.c.s.
Sulphuric acid (10% solution by volume of 1·84 acid) ..	..	5 drs.	50 c.c.s.
Water	..	10 ozs.	1,000 c.c.s.

Applied to a wet negative, gives even reduction. A dry negative receives greater reduction in the high-lights, and great softening may be obtained by immersing dry negative quickly in the reducer, washing immediately, drying and re-immersing. Any brown stains are removed with a 10% solution of sodium sulphite containing 2% oxalic acid.

Bichromate.

Potass. bichromate ..	..	100 grs.	20 gms.
Sulphuric acid	..	7 drs. (fl.)	40 c.c.s.
Water	..	20 ozs.	1,000 c.c.s.

Hypochlor and Alum.

Chrome alum	..	10 grs.	4 gms.
Eau de Javelle	..	½ oz.	100 c.c.s.
(See "Clearing Solutions")			
Water to make	..	5 ozs.	1,000 c.c.s.

Immerse the negative and gently rub the surface with a piece of cotton wool. By confining friction with the wool to certain parts, extra reduction can be obtained.

Reducing Hard Negatives.

A most valuable and perfectly safe method of reducing excessively hard negatives is one dependent on re-development. Bleach the negative first in a solution of ferricyanide and potassium bromide,

using the same bath as is commonly employed for sulphide toning. After a thorough wash re-develop in a developer containing 2 per cent. of rodinal and 1 per cent. of potassium bromide—that is, one containing 1 dram of rodinal and 5 drams of 10 per cent. bromide solution in 6 ozs. of water. . Development will be very slow, but the plate may be left to itself for half an hour or so, as the action cannot go too far. When development is sufficient the plate is fixed, washed, and dried.

Baskett's (Local) Reducer.

It consists of—

Globe metal polish	2d. tin
Terebene	2 ozs.
Salad oil	2 ozs.

The ingredients are to be well mixed, and strained through fine muslin two or three times to remove any coarse particles. Dense parts of a negative are rubbed down with the reducer applied by the finger-tip or with a bit of chamois leather

NEGATIVE VARNISHES.

Hot Varnishes.

No. 1.—	Sandarac	4 ozs.	113 gms.
	Alcohol	28 ozs.	800 c.c.s.
	Oil of lavender	3 ozs.	85 c.c.s.

This is a good varnish for retouching upon, and a tooth is easily obtained by rubbing.

No. 2.—	Seed lac	2 ozs.	50 gms.
	Sandarac	2 ozs.	50 gms.
	Oil of lavender	½ oz.	12·5 gms.
	Castor oil	1 oz.	25 c.c.s.
	Alcohol	40 ozs.	1,000 c.c.s.

To prepare a good surface for the retouching pencil, the negative after varnishing is dusted over with fine resin powder and rubbed up with the fingers.

No. 3.—	White hard varnish . ..	15 ozs.	150 c.c.s.
	Rectified spirit (not methylated spirit)	20 to 30 ozs.	200 to 300 c.c.s

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

Cold Varnishes.

No. 1.—	Celluloid	1 oz.	10 gms.
	Amyl acetate	50 ozs.	500 c.c.s.

To counteract the sickly odour of amyl acetate, add a small proportion of oil of lavender.

This may be flowed over or applied with a brush to the cold negative.

No. 2.—	Zanzibar copal	6 ozs.	30 gms.
	Amber (fused)	1 oz.	5 gms.
	Ether	60 ozs.	300 c.c.s.
	Acetone	40 ozs.	200 c.c.s.
	Chloroform	4 ozs.	20 c.c.s.
No. 3.—	20% shellac solution	2 ozs.	160 c.c.s.
	Ammonia (0·880)	3 drs.	30 c.c.s.
	Methylated spirit	4 ozs.	320 c.c.s.

No. 4.—A mixture of Japanese gold size (1 part) and benzole (2 parts) forms a rather slow-drying though otherwise excellent cold varnish. The surface takes the pencil well.

Shellac Water Varnish.

Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ozs.	800 c.c.s.

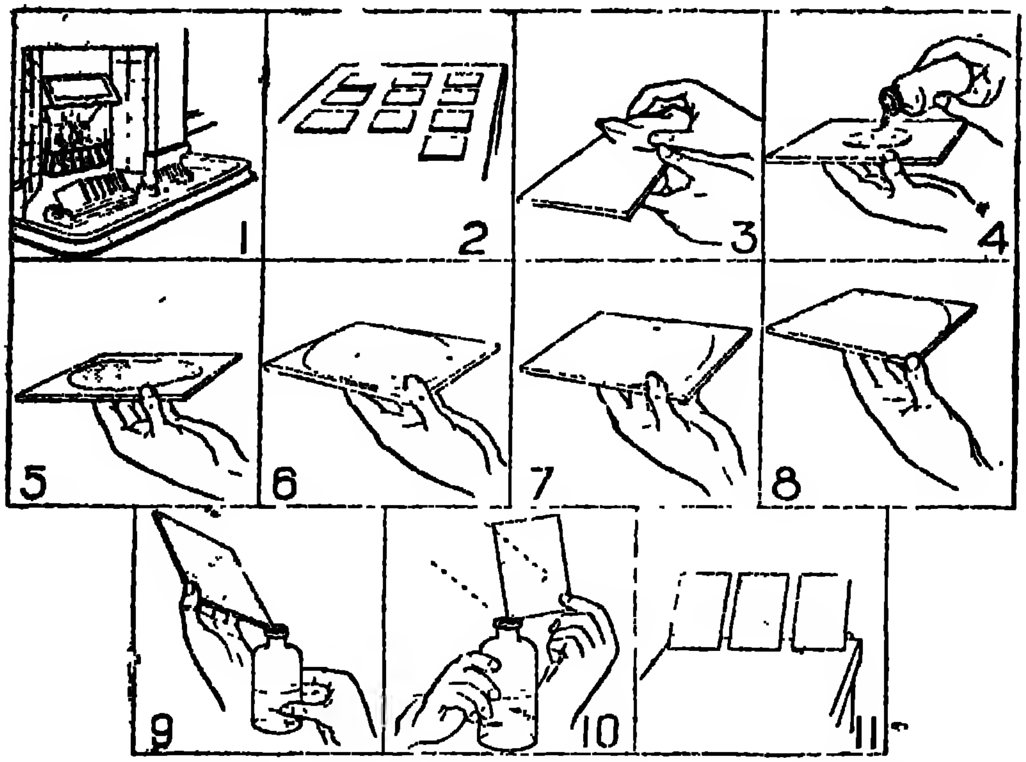
The shellac is allowed to soak in the liquid for twenty-four hours; the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves. After standing some time the liquid becomes perfectly clear and bright.

How to Varnish Negatives.

Using Cold Varnish.

First place negatives where they will become perfectly dry, *e.g.*, near a fire (Fig. 1) or on a bath hot-water tank. Next lay out to get quite cold (Fig 2). Remove dust with a strip of cotton plush or camel's hair brush (Fig. 3). Poise negative on the tips of fingers, steady with thumb, and pour pool of "cold" varnish (bought, or made from one of the formulæ given above), in centre (Fig. 4), using plenty. Let pool spread of itself (Fig. 5). Now incline plate to cause varnish to flow into right-hand far corner (Fig. 6); thence into left-hand far corner (Fig. 7); thence into left-hand near corner (Fig. 8), and then raise negative so as to flow excess of varnish back into bottle (Fig. 9). (N.B.—In tilting negative to distribute varnish, return plate to level position *a little before* varnish has reached the corner; the wave of

varnish will carry the coating into corners, and you will avoid getting varnish on the glass side or up your sleeve.) As last drops run into



bottle, rock negative to and fro (Fig. 10), so as to avoid a streaky coating, and as each negative is thus finished stand it on blotting-paper to dry (Fig. 11).

Film Varnishes.

The above water varnish is suitable, or the following:—

Borax	.. ..	300 grs.	30 gms.
Glycerine	.. ..	300 minims	30 c.c.s.
Shellac	.. ..	600 grs.	60 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	.. .. ..	5 ozs.	250 c.c.s.

and filter.

Another good varnish for celluloid films is—

Dammar	.. ..	500 grs.	115 gms.
Benzole	.. ..	10 ozs.	1,000 c.c.s.

in which, after filtration, the films are immersed and then hung up to dry.

Retouching Medium.

Pale gum resin	.. .. ..	200 grs.	230 gms.
Gum dammar	.. .. ..	90 grs.	100 gms.
Gum mastic	.. .. ..	20 grs.	23 gms.
Oil of juniper	.. .. ..	1 gr.	1 gm.
Oil of turpentine	.. .. ..	2-4 ozs.	1,000-2,000c.c.s.

The gums are powdered and added to the oils, and finally enough pure asphaltum is added to give the mixture a dark amber colour when viewed through the depth of an inch

This formula is strongly recommended by Whiting in his "Retouching" as not liable to pick, rub off, or come off on after-varnishing. It takes a great deal of work.

Ground-Glass Varnish.

Sandarac	90 grs.	103 gms.
Mastic	20 grs.	23 gms.
Ether (0·720)	2 ozs.	1,000 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzole	½ to 1½ ozs.	120-700 c.c.s.

The proportion of the benzole added determines the nature of the matt obtained

This varnish must be applied to the cold negative or the coating will not be matt.

Malachite green, aurantia, or asphaltum is used for tinting it green yellow, or brown respectively (for handwork on back of negative).

Spotting Medium.

Indian ink	water colour chalk.
Payne's grey	water colour chalk.

Grind together with water only on a palette to match the colour of the negative.

Blocking-Out Mixtures.

No. 1.—Gamboge and vermilion red, or Payne's grey and vermilion, are ground together in water in equal parts with addition of a little gum water if a glossy surface is required.

No. 2.—Asphaltum	1 oz.	100 gms.
Wax	170 grs.	40 gms.
Carbon black	80 grs.	20 gms.
Turpentine	10 ozs.	1,000 c c s.

Commercial "Brunswick black" is equal to and more convenient than the above mixture.

When printing on development papers, yellow or orange dye (Vanguard yellow or Griffin's auramine) is a convenient blocking out medium which is easier in use owing to its transparency. First go over the film with ox gall on wet cotton-wool: the dye then diffuses slightly beyond the edge of the brush work and avoids harsh lines. In subjects containing detail such as ladies' hair, or drapery, a weak dye application over the outline will add the necessary density to the background without clogging the hair. Then proceed as usual, with a stronger wash when stray bits not wanted to print can be taken off without waving a sharp edge.

Titles on Negatives.

The usual method is to have the words forming the title set up in type and photographed on a "process" plate. The subject negative having been made with a clear margin round it, a strip of the title

negative is laid down on this margin by stripping and the clear margin then filled up with "photopake" or other blocking-out mixture except over the strip of title, which is made dense enough, in the first instance, to print white. If a clear portion in a landscape negative cannot be found (in cases where the title has to appear on the view), a piece must be cut out with a sharp knife.

STRIPPING.

Gelatine Glass Negatives.

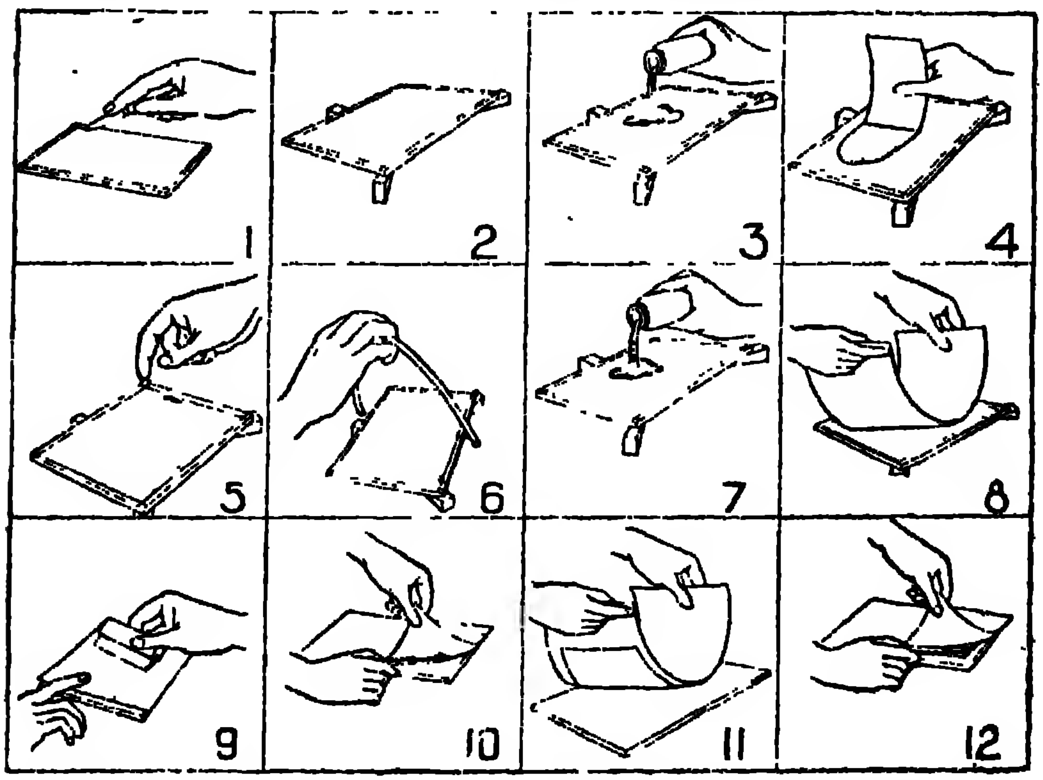
(Middleton and Holcroft.)

The following is the formula and process for stripping the film from a glass negative and transferring it (with or without reversal) to a second glass-plate or other support.

Stock solution: -

Methylated spirit	.. .. .	25 ozs.	250 c.c.s.
Water	.. ..	1 oz.	10 c.c.s.
Glycerine	.. ..	1 oz.	10 c.c.s.

To prepare the "stripping solution" 6 to 30 drops of commercial hydrofluoric acid are added to 1 oz. (30 c.c s.) of the above.



Cut through to the glass all round negative, about $\frac{1}{8}$ inch from edge, with sharp penknife (Fig. 1). Place level on three wooden

wedges (Fig. 2). Pour on "stripping solution" (prepared as above) (Fig. 3). Spread solution with an end of paper (Fig. 4). After a minute or so try (with the finger) if the edgings of film are loose, and remove them as soon as they come away without any pull whatever (Fig. 5). Now test if whole film is loose by passing a waxed silk thread stretched on a bow of cane underneath (Fig. 6). If all is free, pour on some plain "stock solution" (Fig. 7), and apply a sheet of waxed paper (Fig 8). The waxed paper is prepared by soaking thin paper in hot melted paraffin for about half an hour. It is semi-transparent and free from buckle. Lightly squeegee down (Fig. 9), and then remove the two together in contact by slipping the blade of a penknife under the film (Fig. 10) Finally, apply the paper (Fig. 11) with the negative film on the under side, to a glass plate coated with very weak gum solution, dried and flowed over with "stock solution" Then squeegee down (Fig. 9), and remove the waxed sheet, using the blade of the penknife to keep the corner of the film to the glass (Fig. 12).

A less rapid solution, but one which will be safe in the case of an old or hardened negative, is:—

Methylated spirit..	1 oz.	80 c.c.s.
Water	2 ozs.	160 c.c.s.
Hydrofluoric acid	60 minims	10 c.c.s.

These proportions may be slightly altered for different commercial spirits and acids.

Film Negatives.

In the case of negatives on celluloid cut or roll-film the following is a suitable method:--

Caustic soda	10 grs.	23 gms.
Formaline	10 minims	20 c.c.s.
Water	1 oz.	1,000 c.c.s.

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	25 minims	50 c.c.s.
Glycerine	25 minims	50 c.c.s.
Water	1 oz.	1,000 c.c.s.

in which it is removed from its original support to a glass or other base.

WET COLLODION AND COLLODION EMULSION.

Wet Collodion.

PYROXYLINE (HARDWICH).

Sulphuric acid, 1·845	.. ..	18 ozs. (fl.)	600 c.c.s.
Nitric acid, 1·457 ..	.. ..	6 ozs. (fl.)	200 c.c.s.
Water ..	.. .. ..	5-5½ ozs. (fl.)	167-182 c.c.s.
Cotton-wool	.. .. ..	300 grs.	23 gms.

Temperature 150 degrees F. (65 degrees C.) Time of immersion ten minutes.

IODISED COLLODION.

For Acid Pyro Developer.

Ether, specific gravity 0·725	..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0 805	..	4 ozs. (fl.)	400 c.c.s.
Pyroxyline ..	.. .. ..	120 grs.	27 gms.
Ammonium iodide	.. ..	30 grs.	7 gms.
Cadmium iodide ..	.. ..	45 grs.	10 gms.
Alcohol (0·830)	.. .. ..	4 ozs. (fl.)	400 c.c.s.

BROMO-IODISED COLLODION,

For Iron Developer.

Ether, specific gravity 0 725	..	10 ozs (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0 805	..	5 ozs (fl.)	500 c.c.s.
Pyroxyline	.. .. ..	120 grs	27 gms.
Ammonium iodide	.. ..	40 grs.	9 gms.
Cadmium iodide	.. ..	40 grs	9 gms.
Cadmium bromide	.. ..	20 grs.	4·5 gms.
Alcohol (0 830)	.. .. ..	5 ozs. (fl.)	500 c.c.s.

Thinning Collodion after Use.—A mixture of sulphuric ether (0·720), 3 parts, and alcohol (0 805), 2 parts, is generally used.

THE NITRATE BATH.

Silver nitrate	.. .. ..	6 ozs.	75 gms.
Distilled water	.. .. ..	80 ozs. (fl.)	1,000 c.c.s.
Nitric acid (pure) ..	.. ..	8 minims	0 2 c.c.s.

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter.

DEVELOPER.

No. 1.—Ferrous sulphate	.. ..	½ oz.	50 gms.
Glacial acetic acid	.. ..	½ oz.	50 c.c.s.
Alcohol	.. ..	½ oz.	50 c.c.s.
Water	.. ..	10 ozs.	1,000 c.c.s.

No. 2.—Ferrous ammonio-sulphate ..	75 grs.	43 gms.
Glacial acetic acid	75 grs.	43 gms.
Copper sulphate	7 grs.	4 gms.
Water	4 ozs.	1,000 c.c.s.
Alcohol	¼ oz.	60 c.c.s.

INTENSIFIER.

Pyrogallic acid	90 grs	10 gms.
Citric acid	60 grs.	7 gms.
Acetic acid (glacial)	1 oz.	50 c c s.
Water	20 ozs	1,000 c.c.s.

The copper intensifier (see "Intensifiers") is used for greater density, each solution being flowed over the plate with a rinse between.

Positives and Ferrotypes by Wet Collodion.

BROMO-IODISED COLLODION.

Ether, specific gravity 0·725 ..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0·805 ..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	100 grs.	23 gms
Cadmium iodide	50 grs	11½ gms
Ammonium bromide	25 grs.	5·7 gms.
Alcohol, 0·830	5 ozs. (fl.)	500 c.c.s.

Note.—The iodides should be dissolved in the weaker spirit, and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

SILVER BATH.

Silver nitrate (recryst.)	5¼ ozs.	70 gms.
Distilled water	80 ozs. (fl.)	1,000 c.c.s.
Nitric acid (pure)	½ dr	0·8 c.c.

Saturate with iodide of silver and filter as above.

DEVELOPERS.

Ferrous sulphate	150 grs.	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s.
Nitric acid	5 minims.	1 c.c.
Alcohol	½ oz.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

NITRATE OF IRON DEVELOPER.

Ferrous sulphate	1½ oz	75 gms.
Barium nitrate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Alcohol	1 oz.	50 c.c.s.
Nitric acid	40 drops	4 c.c.s.

The insoluble barium sulphate which is formed must be filtered out.

FIXING SOLUTION.

Potassium cyanide	½ oz.	25-30 gms.
Water	15-20 ozs.	1,000 c.c.s.

DEVELOPER FOR COLLODION TRANSFERS.

Pyrogallic acid	4 grs.	9 gms.
Citric acid	3 grs.	7 gms.
Acetic acid	20 minims	41 c.c.s.
Water	1 oz.	1,000 c.c.s.
Alcohol	20 minims	41 c.c.s.

Wet Collodion for Half-Tone.

For Winter.

A.—Pyroxyline (tough)	190 grs.	21 gms.
Ether (0·720)	12 ozs.	600 c.c.s.
Alcohol (0·805)	8 ozs.	400 c.c.s.

For Summer.

B.—Pyroxyline (tough)	190 grs.	21 gms.
Ether (0·720)	10 ozs.	500 c.c.s.
Alcohol (0·805)	10 ozs.	500 c.c.s.

IODIZER.

Cadmium iodide	600 grs.	68 gms.
Ammonium iodide	210 grs.	24 gms.
Sodium iodide	210 grs.	24 gms.
Cadmium bromide	210 grs.	24 gms.
Alcohol	20 ozs.	1,000 c.c.s.

Use: Iodizer, 1 part; collodion, 15 parts: and set the mixture aside for at least 4 days to ripen. It should then be a bright yellow; if not, add to each ounce 1 minim of a solution of:—Iodine, 16 grs.; alcohol, 1 oz.

Collodion Emulsion.

PYROXYLINE FOR COLLODIO-BROMIDE OR UNWASHED EMULSION.

Nitric acid, specific gravity 1·45	2 ozs (fl.)	285 c.c.s.
Sulphuric acid, specific gravity 1·845	4 ozs.	570 c.c.s.
Water	1 oz. (fl.)	145 c.c.s.
Cotton (cleaned and carded) ..	100 grs.	33 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.

FOR WASHED EMULSION.

Nitric acid, specific gravity 1·45	2 ozs. (fl.)	400 c.c.s
Sulphuric acid, specific gravity 1·845	3 ozs.	600 c.c.s.
White blotting-paper	145 grs.	66 gms.

Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.

COLLODIO-BROMIDE EMULSION.

Ether, specific gravity 0·720 ..	5 ozs. (fl.)	620 c.c.s.
Alcohol, specific gravity 0·820 ..	3 ozs.	380 c.c.s.
Pyroxyline..	50 grs.	14·3 gms.
Cadmium ammonium bromide..	80 grs.	23 gms.
or		
Zinc bromide	76 grs.	21·5 gms.

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This s suitable for slow landscape work or for transparencies.

WASHED EMULSION (for Transparencies).

Ether, specific gravity 0·720 ..	5 ozs. (fl)	620 c.c.s.
Alcohol specific gravity 0 820 ..	3 ozs.	380 c.c.s.
Pyroxyline or papyroxyline ..	60 grs.	17 gms.
Cadmium ammonium bromide ..	100 grs.	29 gms.
or		
Zinc bromide	96 grs.	27·5 gms.
Hydrochloric acid (specific gravity 1·2)	8 minims	2 c.c.s.

Sensitise with 20 grs. of silver nitrate to each ounce (4·3 gms. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol Allow to stand for two or three days.

N.B.—In the last formula the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

Stripping Wet Collodion Negatives.

When the negative is thoroughly dry and cool, flow over with thin solution of rubber in benzole, 2 parts pure rubber to 100 parts benzole, or ordinary cycle tyre repairing solution thinned down to about the consistency of collodion will do. When this is dry, the negative is flowed over with "leather" collodion. This is prepared by adding a small quantity of castor oil to plain collodion. A good formula is as follows:—

Pyroxyline (tough)	½ oz.	2 gms.
Ether	5 ozs.	50 c.c.s.
Alcohol	5 ozs.	50 c.c.s.
Castor oil	½ oz.	2 c.c.s.

When the collodion on the negative is dry (and the drying can be hastened by heat) the negative is cut round the edges with a knife

and placed in a dish of cold water The film should soon begin to loosen at the edges If it does not a little acetic acid (up to 10 per cent) may be added to the water The film is now transferred to a piece of paper, and thence to the new support If the negative is to be reversed it is transferred to another piece of paper before being placed on its final support

Pyroxyline, for leather collodion and the wet collodion process, replacing certain German products will it is hoped be made before long by the New Explosives Co Ltd 62 London Wall London, E C

PLAIN AND ALBUMEN PAPERS.

Plain Paper.

The following are formulæ for salting and sensitizing papers such as Whatman's drawing paper etc

First prepare the plain paper with

Ammonium chloride	60–80 grs	14–18 gms
Sodium citrate	100 grs	23 gms
Sodium chloride	20–30 grs	4.5–7 gms
Gelatine	10 grs	2 gms
Distilled water	10 ozs	1 000 c c s

or—

Ammonium chloride	100 grs	23 gms
Gelatine	10 grs	2 gms
Water	10 ozs	1 000 c c s

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added The solution is filtered, and, when still warm, the paper floated upon it for three minutes and dried

The salted paper is sensitized upon a neutral 45 grain silver bath

Platinum Toning Bath

Potass. chloroplatinite . .	4½ grs	1 gm.
Water . .	10 ozs.	1,000 c c s
Nitric acid	2–3 drops	5–10 drops.

Albumen Paper.

The albumenized paper, as purchased, is sensitized on the following silver solution :—

Silver nitrate	.. .. ..	600 grs.	140 gms.
Distilled water	.. .. ..	10 ozs.	1,000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs.

TONING BATHS.

No. 1.—Gold chloride	.. .. ..	1 gr.	0·3 gm.
Sodium acetate	.. .. ..	30 grs.	6 gms.
Water	.. ..	8 ozs.	1,000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2 —Gold chloride	.. .. ..	15 grs.	1 gm.
Water	.. ..	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add—

Calcium chloride, fused	.. ..	120 grs.	7·7 gms.
Water to make	.. .. ..	$7\frac{1}{2}$ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath; it can be used over and over again by addition of stock solution.

PRESERVATIVE FOR SENSITIZED ALBUMEN PAPER.

Sensitize the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of—

Citric acid	.. ..	1 oz.	33 gms.
Water	.. . .	30 ozs.	1,000 c.c.s.

TO PREVENT BLISTERS IN ALBUMEN PRINTS.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

GELATINE P.O.P.

Emulsion Formulæ.

BARKER'S.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	.. ..	175 grs.	80 gms.
Ammonium chloride	.. ..	18 grs.	8 gms.
Rochelle salts	.. .. ..	50 grs.	23 gms.
Silver nitrate	.. .. ..	75 grs.	34 gms.
Alcohol	.. ..	4 drs.	160 c.c.s.
Water	.. ..	5 ozs.	1,000 c.c.s.

Heat to 100 degrees F (38 degrees C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

Procedure in P.O.P. Printing.

Wash prints in several changes of water until wash water ceases to show milkiness when poured into clean glass measure (time, 10 to 15 minutes). Tone in gold bath (5 to 10 minutes). Again wash as thoroughly as before toning. Fix in. hypo, 2 to 3 ozs.; water, 20 ozs., for 10 minutes. Finally wash in running water or frequent changes (every 5 or 10 minutes) for 1 to 2 hours.

Prints can be toned in a platinum bath instead of in one of gold (see formulæ below). The other manipulations remain the same as above. The tones are best suited to matt surface paper.

Prints can be toned and fixed at the same time in a "combined" bath (see formulæ below). With some baths and papers it is best to wash before toning; with others it is not necessary. The tones by the "combined" method are almost always warmer than by separate toning and fixing Also they are somewhat inferior in permanence.

P.O.P. prints may be printed faintly and then developed up to full strength (see "Developing P.O.P." below). The colour of the developed prints is usually not pleasing, and it is necessary to tone. This is done as a rule in a combined bath. P.O.P. to be developed must not be exposed to strong light before printing, when loading frames or examining prints It must be handled as though it were "gaslight" paper.

Gold Toning Baths.

Sulphocyanide.

This is the best and most generally used toning bath for P.O.P. and yields fine purplish tones.

Gold chloride	$2\frac{1}{4}$ grs.	0.3 gm.
Ammonium sulphocyanide ..	30 grs.	3.5 gms.
Water	20 ozs.	1,000 c.cs.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other—both scalding hot. Then pour the gold into the sulphocyanide in small doses, stirring all the time: use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

Short Stop for Gold Toning.

A weak solution of sodium sulphite (5 grs. per oz.) at once arrests the action of a gold toning bath.

SALT BATH.

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	..	2 ozs.	100 gms.
Sodium carbonate	..	1 oz.	50 gms.
Water	..	20 ozs.	1,000 c.c.s.

If prints are to be toned in the platinum bath the carbonate should be omitted.

Combined Baths.

VALENTA'S.

Hypo	..	8 ozs	400 gms.
Ammonium sulphocyanide	..	1 oz.	50 gms.
Lead nitrate	..	175 grs.	20 gms.
Alum	..	350 grs.	40 gms.
Water to	..	20 ozs.	1,000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120 deg. F. for ten minutes ; allow to cool. For use take—

Stock solution (as above)	..	10 ozs.	100 c.c.s.
Water	..	10 ozs.	100 c.c.s.
Gold chloride (from stock sol.)	..	3½ grs.	0·23 gm.

ALKALINE TONING AND FIXING BATH.

Gold chloride	..	2 grs.	0·23 gm.
Lead nitrate	..	10 grs.	1 2 gm.
Chalk	..	½ oz.	25 gms.
Hypo	..	4 ozs.	200 gms.
Water	..	20 ozs.	1,000 c.c.s.

Shake the solution well, allow to settle, and use the clear portion. If prints tone too quickly, under 10 minutes, in the combined bath, it is best to pass them afterwards through a plain fixing bath.

Reducer for Over-Printed Proofs.

A.—Ammonium sulphocyanide	..	10% sol.
B.—Potass. ferricyanide	..	10% sol.

A, 5 ozs. ; B, ½ oz. ; water, 24 ozs.

This is used on the prints after toning, fixing and well washing out the hypo in the usual way.

Developing P.O.P.

DIRECT PROCESS WITH ACID DEVELOPER.

Hydroquinone	..	16 grs.	18·5 gms.
Citric acid	..	40 grs.	4·6 gms.
Sodium acetate	..	1 oz.	50 gms.
Water	..	20 ozs.	1,000 c.c.s.

Immerse the dry prints in the developer, and, after development, wash in plenty of water for ten or fifteen minutes, then tone in the usual way.

PAGET "BROMIDE" PROCESS.

The prints are immersed in 10 per cent. potass. bromide solution for five or ten minutes, washed and developed with the following:—

A.—Hydroquinone	.. .. ..	40 grs.	4·5 gms.
Sodium sulphite	.. .. ..	160 grs.	18 gms.
Water to	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. bromide	.. .. ..	2½ ozs.	125 gms.
Sodium carbonate	.. ..	2 ozs.	100 gms.
Water to	.. .. ..	20 ozs.	1,000 c.c.s.
C.—Potass. cyanide	.. .. ..	½ oz.	25 gms.
Water	.. .. ..	20 ozs.	1,000 c.c.s

For average negatives, mix.—A, ½ oz.; B, 1 oz.; C, 20 minims; water, ½ oz.

For flat negatives (greater contrast), A, 3 drs.; B, 1 oz; water, 5 drs.

For hard negatives (soft results), A, 7 drs.; B, 1 oz.; water, 1 dr.

The cyanide solution is used as above in quantity sufficient to keep the backs of prints clean.

Glazing P.O.P.

POLISH FOR SQUEEGEEING GLASSES.

A polishing medium to be applied to glass or ferrotype before squeegeeing the print is—

Beeswax	.. ..	20 grs	45 gms.
Turpentine	.. ..	1 oz.	1,000 c.c.s.
or			
Spermaceti wax	.. .. ..	20 grs	45 gms.
Benzole	.. ..	1 oz.	1,000 c.c.s.

a few drops of which are rubbed on with a piece of flannel, and the glass afterwards polished with silk rag or chamois leather.

ENAMEL COLLODION.

Soluble gun cotton	.. ..	50 grs.	14 gms.
Alcohol	.. ..	4 ozs.	500 c.c.s.
Sulphuric ether	.. .. ..	4 ozs.	500 c.c.s.

Glass plates cleaned with French chalk are coated with the above, and, as soon as coating has set, slipped under prints which are waiting face down in water. Prints are withdrawn and squeegeed. When half dry they are given a backing paper and finally stripped off (For both gelatine and collodion prints.)

COLLODIO-CHLORIDE P.O.P.

Procedure in C.C. Printing.

Prints are washed in changes of water until latter is free from milkiness, and then toned either with gold or platinum, but most usually and for the best warm black tones, first in gold and then (after washing) in platinum. They are then again well washed and fixed like gelatine P.O.P. prints. C.C. prints as a rule do not yield the best results in the combined bath. C.C. papers are not suitable for the "development" process described under Gelatine P.O.P.

Gold-Platinum Toning.

For Black Tones.

The following is the usual practice in toning collodion prints :—

Wash in several changes, and tone the shadows to a brown (when seen by transmitted light) in the following :—

Borax	90 grs.	10 gms.
Gold chloride	2 grs.	0·2 gm.
Water	20 ozs.	1,000 c.c.s.

This bath is ready within a few minutes of mixing. It is conveniently made just before washing the prints. The quantity of borax is adjusted to the working. If the lighter tones disappear, add more borax; if the prints lack brilliance, add gold. After a ten-minute wash, transfer to the platinum bath, which may be strong or weak, the only difference being that a larger number of prints may be treated together in the weaker bath.

Stock solution :—

Potass. chloroplatinite	30 grs.	7 gms.
Phosphoric acid (specific gravity 1·12)	5 drs.	30 c.c.s.
Water to make	20 ozs	1,000 c.c.s.

This may be made up to 60 ozs. at once, or added little by little to water, as the prints are passed through a few at a time.

The prints are next washed in about eight changes of water (to the fifth or so of which it is well to add a little bicarbonate of soda to neutralise traces of acid) before fixing.

Gold Toning Baths.

BORAX-ACETATE.

Borax	90 grs.	10 gms.
Sodium acetate	90 grs	10 gms.
Gold chloride	$2\frac{1}{4}$ grs.	0.3 gm.
Water	20 ozs.	1,000 c.c.s.

SULPHOCYANIDE.

Ammonium sulphocyanide ..	90 grs	10 gms.
Gold chloride	$2\frac{1}{4}$ grs.	0 3 gm.
Water	20 ozs.	1,000 c c.s.

For bluish-black tones.

SULPHOCYANIDE-ACETATE.

Ammonium sulphocyanide ..	35 grs.	4 gms.
Sodium acetate	$\frac{3}{4}$ oz.	45 gms.
Gold chloride	5 grs.	0·6 gm.
Water	20 ozs.	1,000 c.c.s.

Is made up one hour before using, preferably from stock solutions of the substances. With sodium tungstate, instead of the acetate, gives fine chestnut tones.

The maker's formulæ should be studied in connection with the above baths as papers differ considerably in the quantity of gold required in the toning solution.

Platinum Toning Baths.

The phosphate formula given above under "Gold Platinum Toning" is suitable for the production of the warm brown and sepia tones, which are given by the platinum baths alone. Others are :—

Citric acid	45 grs.	5 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

Lactic acid (specific gravity 1 21)	25 grs.	3 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

SALT-BICARBONATE BATH.

The following is used between washing and toning with the platinum bath as a means of removing free silver, and bringing the prints into a state of regular neutrality .—

Salt	½ oz.	25 gms.
Sodium bicarbonate ..	45 grs.	5 gms.
Water	20 ozs.	1,000 c.c.s.

Toning Baths for Various Warm Tones.

For Warm Sepia Tones.

The prints are washed in three changes of warm water and placed in :—

Ammonia	1 dr.	6 c.c.s.
Warm water	20 ozs.	1,000 c.c.s

until they become lemon yellow. They are then again washed in three changes of water and toned for about one minute in the gold borax bath above.

For Red Chalk Tones

The prints are washed in a couple of changes of water and placed for about half an hour (until they become orange-yellow) in .—

Salt	1 oz	50 gms.
Water	20 ozs	1.000 c c s.

After which they are washed for about one minute and toned, for a few seconds only, in the borax bath above.

For Violet Tones.

Print deeply from the negatives and tone until the colour desired is reached in :—

Hydrochloric acid	6 ozs.	300 c.c.s.
Gold chloride	10 grs.	1 2 gm.
Water to make	20 ozs.	1.000 c.c.s.

After which wash thoroughly and fix in 5 per cent. hypo. Less acid in the above bath tends to bluish-violet, more to violet-purple.

Combined Baths.

Collodion papers, although not generally suitable for use with the combined bath, may in some cases be toned in it. The Valenta formula (see Gelatine P.O.P. above) is suitable, also the following (*Kurz*):—

Water	20 ozs.	1,000 c.c.s.
Hypo	5 ozs.	250 gms.
Ammonium sulphocyanide	240 grs.	28 gms.
Alum	70 grs.	7.5 gms.
Citric acid	70 grs.	7.5 gms.
Lead nitrate	90 grs.	10 gms.
Lead acetate	90 grs.	10 gms.
Gold chloride	3½ grs.	0.4 gm.

It is turbid when first mixed, but clears after a few days.

BROMIDE AND GASLIGHT PAPERS.

Procedure.—Bromide paper must be handled in yellow or orange light; gaslight can be worked in weak daylight or artificial light. Bromide papers develop in from two to five minutes, whilst many (but not all) gaslight papers develop in a second or two. Apart from these distinctions the general working of the two classes of paper is the same, viz., exposure which has no visible effect on the paper; development; a brief rinse; fixing in hypo, 3 to 4 ozs., water 20 ozs.; and thorough washing in running water or frequent changes, say for one hour.

The following developers are a few only of the standard. The makers' formulæ should be consulted.

Amidol.

Sodium sulphite	650 grs.	74 gms.
Potass bromide	10 grs.	1.2 gm.
Water ..	20 ozs.	1,000 c.c.s.
When dissolved add—		
Amidol	50 grs.	5.7 gms.

This developer will not keep more than three days.

See also the formula given under "Negative Developers."

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite, and add 5 grs. potassium bromide to each 10 ozs. solution. For use add 4 grs. dry amidol to each ounce stock solution, and dilute with an equal bulk of water.

Monomet.

The stock solution is that given under "Developers and Development" (negative-) on an earlier page. For gaslight papers it is used as it is: for bromide papers it is mixed with an equal bulk of water.

Monomet-Hydroquinone.

The stock solution is that given under "Developers and Development" (negatives). For gaslight papers this is used as it is, for bromide papers it is mixed with an equal bulk of water.

Scalol.

The stock solution is that given under "Developers and Development" (negatives) and is used as there directed.

Scalol-Hydroquinone.

The stock solution is that given under "Developers and Development" (negatives), and is used as there directed.

Ferrous Oxalate.

A.—Sulphate of iron	.. .. ..	5 ozs.	250 gms.
Sulphuric acid	.. .. ..	30 minims	3 c.c.s.
Warm water to	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. oxalate (neutral)	.. ..	5 ozs.	250 gms.
Potass. bromide	.. .. ..	10 grs.	1·2 gm.
Warm water to	.. .. ..	20 ozs.	1,000 c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versâ*.

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

ACID BATH.

Glacial acetic acid	.. ..	1 dr.	6 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

Then wash thoroughly to remove last trace of acid.

Clearing Bath.

To remove yellow stain from bromide prints, the following is suitable:--

Alum (saturated solution)	..	10 ozs.	1,000 c.c.s.
Hydrochloric acid	.. ..	3 drs.	40 c.c.s.

Reducer for Bromides.

Over-developed prints are best treated in a weak iodine-cyanide reducer made from (A) 10% solution of iodine in potass. iodide and (B) 10% potass. cyanide solution. Take:—

A.	.. ..	30 minims	2 c.c.s.
B.	.. ..	10 minims	0·6 c.c.
Water	.. ..	2 ounces	60 c.c.s.

Adding more of A and B if necessary.

Strong Prints from Flat Negatives.

The prints are fully exposed and over-developed, fixed and washed. They are then placed in the following iodine bath until whites are strongly blue, and then fixed for five minutes.

IODINE BATH.

Potass. iodide	30 grs.	7 gms.
Iodine	3 grs.	0·7 gm.
Water	10 ozs.	1,000 c.c.s.

If not sufficiently lightened, the print may be washed and the process with bleaching bath and hypo repeated.

Stress Marks on Bromides.

Avoid rubbing paper against other sheets in boxes or packets, and against negative or mask. In cutting up large sheets, use shears on open sheet, not knife, etc., which rubs on emulsion surface. Have developer water-clear, free from sediment and any floating dirt. Use plenty of developer.

Addition of from 40 to 60 minims of 10 per cent. solution of potass. cyanide to each 10 ozs. of developer will avoid stress marks in many cases, or a developer may be made up as follows:—

Soda sulphite	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bromide	2 grs.	0·23 gm.
Amidol	35 grs.	4·0 gms.
Potass. cyanide	2 grs.	0·23 gm.

If stress marks occur, they can usually be removed by gently rubbing each print with a soft rag as soon as it has had a minute or so in the wash-water. A further aid to removal is a solution of borax, ½ oz.; water, 20 ozs.; methylated spirit, 5 ozs., rubbed over with soft rag or cotton wool.

Hypo-Alum Toning.

The following is a method (much used on the commercial scale) for toning bromide prints to a warm purplish sepia:—

Hot water	20 ozs.	1,000 c.c.s.
Hypo	2½ ozs.	125 gms.
Dissolve and add—		
Alum	½ oz.	25 gms.

This mixture should not be filtered, and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried.

A new bath tends to reduce the prints rather more than an old one. When toned the prints should be placed in a tepid solution of—

Water	.. ..	70 ozs.	1,000 c.c.s.
Alum	.. ..	2 ozs	30 gms.

and then washed thoroughly.

Sulphide Toning.

Of the many methods of producing sepia to warm brown tones on bromide or gaslight the following is the best and most reliable. Prints require to be well washed from hypo before being put into the bleacher. In summer, or in places where the water supply has a softening action on prints, it is well to fix them in a fixing hardening bath. (See "Fixing.")

BLEACHER.

Ammonium bromide	.. ..	100 grs.	11 gms.
Potass. ferricyanide	.. ..	300 grs.	35 gms.
Water	.. ..	20 ozs.	1,000 c.c s.

SULPHIDE BATH.

It is best to keep the sulphide in strong, 20 per cent., solution; a weak solution does not keep well. Use the pure *white* sulphide, dissolving 4 ozs. in water and making up to 20 ozs.

To make the working sulphide bath, mix:—

Stock 20% sulphide solution	.. .. ..	3 ozs.
Water to make	.. ..	20 ozs.

The prints are treated for two or three minutes in the bleacher—that is, until the picture becomes faint brown in colour. If any black is left at the end of two minutes it is a sign that the bleacher (which may be used repeatedly) is becoming exhausted.

Rinse in clean water for half-a-minute to one minute. Longer washing at this stage does no good and may lead to impaired tone.

Transfer to sulphide bath, where prints should darken to the full brown or sepia in a second or two.

Throw away the sulphide bath after the day's use. Stale spoilt sulphide solution is the most frequent cause of bad tones or of refusal of prints to darken in the sulphide bath.

Finally wash for half-an-hour in running water.

The results by the sulphide process are quite permanent.

Blue stains in spots and patches, on sulphide-toned prints, are due to iron, either as rust in the tap-water, or as impurity in alum. Fit a flannel filter to the tap and use pure alum. Wiping with cotton-wool saturated with strong hydrochloric acid will slowly change the stain to yellow which washes out in water. But it is a rather risky remedy.

Sulphide-toned prints of bad colour or insufficient depth can be re-treated, e.g., by bleaching in:—copper bromide, 130 grs.; sodium bromide, 2¼ ozs.; water, 10 ozs. This is used in the dark-room, the

bleached print taken into daylight and re-developed with amidol or other clean developer, after which it may be retoned.

Permanganate Bleach Process.

(*T. H. Greenall's formula.*)

This process allows of prints being toned after a very brief rinse from the fixing bath; also it requires no washing (or only the briefest) between bleaching and sulphiding.

BLEACHER

A.—Hydrochloric acid B.P. 31·8%	..	3 ozs.	150 c.c.s.
Water to make	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. permanganate	.. ..	40 grs.	4.5 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Both A and B keep indefinitely when well stoppered.

To make the bleacher, mix in order given:—Water, 6 ozs.; A, 1 oz.; B, 1 oz. Cost of working mixture is about ½d. per 20 ozs. If prints do not bleach completely, throw bleacher away and mix fresh. Any brown stain disappears in the sulphide bath, which should be of strength 1 gr. per oz. made up from strong solution.

If, by using more of A or B than directed above, there is any brown stain on sulphided prints, a bath of oxalic acid, ½ oz.; water, 50 ozs., with a few crystals of soda sulphite dissolved in it, will at once remove them.

Copper Toning.

This process yields a range of tones from warm black to red chalk, the warmth of tone increasing as the solution acts on the print. The process does not intensify the prints; it is cheap and the results are permanent.

A.—Copper sulphate	.. ..	60 grs.	7 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	50 grs.	6 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of each. If prints are pinkish in the high-lights, use more citrate in the A or B solution.

Uranium Toning.

This old method yields brown to reddish tones. It intensifies the prints, and the results often prove impermanent.

A.—Uranium nitrate	.. .. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo.

After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. Citric acid (10 grs. per oz.) or oxalic acid (5 grs. per oz.) instead of acetic is an aid to pure whites.

As a means of rendering uranium-toned prints permanent, it is recommended to fix the toned prints for five minutes in hypo, ½ oz.; potass. metabisulphite, 70 grs.; water, 20 ozs.

Green Tones.

(*H. E. Smith's formula without scheduled poisons.*)

A.—Potass. ferricyanide	.. ..	180 grs.	2 gms.
Water, distilled	.. .. ..	20 ozs.	100 c.c s.
B.—Vanadium chloride stock solution		3½ drs.	4 c.c s.
Ferric ammonium citrate (*green* scales)	.. ..	45 grs	1 gm.
Soda citrate neutral (Merck)	..	2½ ozs.	25 gms.
Ammonium chloride	.. ..	90 grs.	2 gms.
Hydrochloric acid, strong pure	..	1¼ ozs.	14 c.c.s.
Water distilled	.. .. ..	10 ozs.	100 c.c.s.

The stock vanadium solution is made by mixing 1 oz. of vanadium chloride, as purchased (Merck's syrupy), with 5 drams (12 c c.s.) of strong hydrochloric acid and then adding distilled water to make 2 ozs. 90 minims (62 c.c.s.) in all.

In making up the B solution, first add the hydrochloric acid to the vanadium solution. Then dissolve the ferric citrate, soda citrate, and ammonium chloride in the 10 ozs. (100 c.c.s) water and mix the two. Solution should be dull mauve blue, not green until mixed with A.

Both A and B solutions will keep for months at least.

To mix the toning solution, take 1 part A with 4 parts water; and, separately, 1 part B with 4 parts water. The two weak solutions when mixed together form the toner.

Prints tone in from 4 to 8 minutes. Rock constantly, then wash in 5 changes of water, each of 2 minutes, give a bath of hydrochloric acid (1 part in 50 parts water) for 2 minutes, and finally wash for 15 minutes in 7 or 8 changes of water.

Prints should be of the ordinary depth. The green tone is permanent.

Blue Tones.

10% solution ferric ammonium citrate	.. ..	2 ozs	10 c c s.
10% solution potassium ferricyanide	.. ..	2 ozs.	10 c.c.s.
10% solution acetic acid	.. ..	20 ozs.	100 c.c s.

The well-washed prints are immersed in this bath until the desired tone is given. Then well wash until high-lights are clear. This bath intensifies the image.

* * * * *

Practically all the above toning solutions can be employed for lantern plates.

Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drs. (fl.)	25 c.c.s.
Water	20 ozs.	1,000 c.c.s.

Or in—

Iodine sol. (10 per cent. in potass. iodide sol.)	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)..	5 minims	1 c.c.s.
Water	1 oz.	100 c.c.s.

THE CARBON PROCESS.

Procedure.—Tissue, *i.e.*, paper coated with a mixture of gelatine and pigment colour, is made sensitive by immersion in bichromate solution, dried, and printed under the negative by daylight. As the colour of the tissue hides the effect of light, the printing is done by aid of an actinometer.

The effect of the light is to render the gelatine insoluble—deeper down into the tissue, the greater the action. "Development" consists in dissolving out in warm water the tissue which remains soluble. As a skin of insoluble tissue is formed over the whole top surface of the print, the coating is first transferred (face down) on to a fresh support. To do this, the exposed tissue is soaked in cold water along with a sheet of (gelatine coated) transfer paper, the two squeegeed together, put under pressure for about 20 minutes, and then placed in hot water. The original support of the sensitive surface is stripped off, leaving the tissue with its face (the insoluble side) on the transfer paper. The soluble gelatine can be then dissolved away (development), carrying the pigment with it, and the prints are finally passed through an alum bath, washed and dried. As this transference of the print to a new support causes the picture to appear reversed as regards right and left, it is necessary (where this is an objection) to transfer first on to a "temporary support" for development, and from this again on to the "final support."

Sensitising Solutions.

Potass. bichromate	1 oz.	35–50 gms.
Water	20–30 ozs.	1,000 c.c.s.
Liquor ammonia (0·880).. ..	60 minims	6 c.c.s.

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising, the degree of squeegeeing (light or heavy) also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

The following has been recommended:—

Potass. bichromate	1 oz.	20 gms.
Water	50 ozs.	1,000 c.c.s.
Citric acid	¼ oz.	5 gms.
Liquor ammonia	q.s. to change tint of solution to lemon yellow.	

This bath is suitable for thin negatives, *i.e.*, those lacking in contrasts, and the tissue sensitised in it will keep longer than that sensitised in the former solution. The tissue, however, is much less sensitive, and with vigorous or contrasty negatives, such as are best suited for carbon work, it is apt to yield prints that are hard, through the washing away of the more delicate tones in the development.

FIXING OR HARDENING BATH.

Alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

Waxing Solutions.

FOR CARBON PRINTS, OR FOR REMOVING COLLODION FILMS.

No. 1.—Beeswax	20 grs.	10 gms.
Benzole rect. No. 1	4 oz.	1,000 c.c.s.

FOR FLEXIBLE SUPPORTS (AUTOTYPE).

No. 2.—Yellow resin	180 grs.	42 gms.
Yellow beeswax	60 grs.	14 gms.
Rectified spirits of turpentine	10 ozs.	1,000 c.c.s.

Gelatine Solutions.

For transferring carbon pictures from flexible support to ivory, opal, glass, &c

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water	12 grs.	1·4 gm.

For coating drawing-papers for the single transfer process—

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) water	20 grs.	2·3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

SUBSTRATUM FOR CARBON TRANSPARENCIES.

Nelson's No. 1 gelatine	¾ oz.	37 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate	12 grs.	1·4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

TO REMOVE BICHROMATE STAINS FROM FINGERS, NAILS.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

THE OIL PROCESS.

Procedure.—Gelatine-coated paper is sensitised with bichromate, printed under the negative, and treated in cold water. The faint image has the power of fixing greasy ink. This is applied with a brush, usually accentuating or suppressing parts of the subject at the worker's discretion.

Double-transfer papers, as used in the carbon process or other papers (gelatine-coated), sold for the purpose, are sensitised in a solution of bichromate of potash of 5 per cent. strength as for carbon printing. The citric acid sensitiser given above under "Carbon" is very suitable, but the most satisfactory method on the whole is the use of a quick-drying spirit sensitiser.

SPIRIT SENSITISER.

(*Demachy*)

Prepare 6 per cent. ammonium bichromate by dissolving 1½ ozs. of this salt in 25 ozs. of water.

To make the sensitiser mix at time of use:—

Stock bichromate solution	1 part
Alcohol, pure 90°	2 parts

The sensitiser is applied with a flat hog-hair brush, about ¾ oz serving for six 10 × 8 sheets of transfer paper.

The paper dries in about 18 minutes, and is printed under the negative until it shows a brown image as in the platinum printing process. The detail should show in the high-lights. It is then soaked in several changes of water to remove the yellow bichromate (about 20 minutes), and then soaked for a further time (in a dish of water), depending on the thickness of the gelatine coating. An average time is 30 minutes; 2 to 3 hours for more heavily coated papers. The temperature of the water should be between 65° and 70° F., and should be kept steady by placing the dish in a place at this temperature. The print can be pigmented forthwith, or dried for pigmenting later on. If it is dried it requires about an hour's soaking in water at 65° to 70° F. to bring it into the best condition for pigmenting.

THE BROMOIL PROCESS.

In this form of the oil process a bromide print or enlargement is treated so as to remove the image and at the same time bring the print into the same condition as that produced by exposure of sensitised paper in the oil process.

C. Welborne Piper's Formula.

The bromide enlargement must be fully exposed and developed, using a slow-acting amidol developer for preference, and it must be thoroughly fixed, washed and dried. It is then bleached in

Ozobrome solution	4 parts
Potash alum 10% solution ..	4 parts
Citric acid, 10% solution	1 part
Water to make ..	20 parts

It is washed and then immersed in sulphuric acid (1 part to 20 water) for from 2 to about 3 minutes, again washed by soaking for a few minutes, and then fixed for 2 or 3 minutes in

Hypo	2 ozs.
Soda sulphite	½ oz.
Water to make	20 ozs.

After this it is washed again and then pigmented like an ordinary oil print. The solutions and washing water used should not be under 60 deg. or over 70 deg. F., and the preparation of the print should not occupy longer than 20 minutes.

The ozobrome solution used is that specially supplied for bromoil by the Ozobrome Company.

The above is the process originally published by Mr. Welborne Piper, and is still as reliable a method as any. For alternative bleachers, &c., which have been proposed, see "Epitome of Progress," B.J.A., 1909, p. 618; 1910, p. 571; 1911, p. 587; 1912, p. 628; 1913, p. 672; 1914, p. 671; 1915, 490, and under "Bromoil" in the present volume.

Pigmenting Oil and Bromoil Prints.

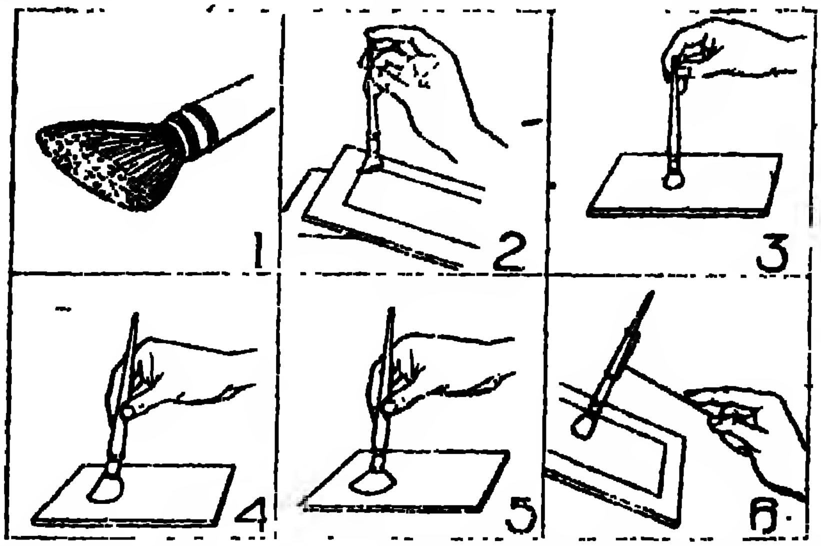
The brush chiefly used is the pied de biche, or hare's foot, of dome shape (Fig. 1).

In dabbing on pigment, rest elbow on table, press bristles at toe of brush first on paper, and bend and spread a little before heel comes down (Fig. 2).

Another touch is to hold brush lightly between first two fingers and thumb, lower brush on to print, and dab four or five times a second, the brush hardly leaving surface (Fig. 3).

Or hold brush (firmly) lower down (Fig. 4).

And apply vigorously, with slight dragging action, from heel to toe for strong effects (Fig. 5).



In "hopping," hold brush on wire and apply in taps, coming an inch or so from print each stroke (Fig. 6); lightens light and strengthens dark tones.

PLATINUM PRINTING.

In the platinum process, paper is coated with a mixture of sensitive iron (ferric) salts with which are platinum salts. By exposure to light the ferric salts become reduced to ferrous salts, and then are able to reduce the platinum in the paper as a black or sepia deposit, forming a highly permanent print. The "developer" in which this takes place is a solution by which the ferrous salts are brought into a soluble state. The developer is used hot or cold, according to the nature of the paper and the kind of tone required.

Procedure in the Platinum Process.—Prints are developed by floating for from 15 seconds to 1 minute on a bath, the chief chemical in which is always potash oxalate. Without washing, they are placed in a bath (No. 1) of 1 in 80 pure hydrochloric acid for 5 minutes, into a second bath for 5 minutes, again into a third, and are then washed in running water for 15 minutes. Time in all, about half-an-hour.

Cold Bath Developers.

Potass. oxalate	2 ozs.	100 gms.
Potass. phosphate..	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

FOR SEPIA TONES ON COLD BATH BLACK PAPER.

A.—Potass. oxalate	.. .. ..	2 ozs.	20 gms.
Water	.. ..	15 ozs.	150 c.c.s.
B.—Potass. citrate	.. .. ..	160 grs.	23 gms.
Citric acid ..	.. .. ..	250 grs.	39 gms.
Mercuric chloride..	.. ..	95 grs.	14 gms.
Water	.. ..	15 ozs.	1,000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Developer for Sepia Paper.

HOT BATH.

Potass. oxalate	.. .. ..	2 ozs.	100 gms.
Potass. phosphate..	.. ..	1 oz.	50 gms.
Citric acid ..	.. .. ..	180 grs.	20 gms.
Potass. chloride ..	.. ..	90 grs.	10 gms
Water	.. ..	20 ozs.	1,000 c.c.s.

Various Platinum Formulæ.

RECOVERING OVER-EXPOSED PRINTS.

Immerse for about two minutes in the oxalate developer. Transfer for one second to a bath of 1 to 20 hydrochloric acid. Return to the developer, and treat as usual.

INTENSIFIER FOR PLATINUM PRINTS.

A.—Sodium formate ..	.. ..	45 grs.	100 gms.
Water	.. ..	1 oz.	1,000 c.c.s.
B.—Platinum perchloride	.. ..	10 grs.	1 gm.
Water	.. ..	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. of water (3 c.c.s. to 100 c.c.s.

RESTORING YELLOWED PRINTS.

Shake up bleaching powder with about five times its weight of water, pass through a sieve, and to the portion which passes through add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

CLEANING SOILED PRINTS.

Alum (one teaspoonful) is dissolved in about 8 ozs. of water, and mixed in a basin with a handful of flour to a cream-like consistency. This mixture is applied to the platinum print with a soft brush, and washed off in running water.

PLATINUM RESIDUES.

Exhausted developers—and the acid baths if in quantity—are mixed in a large jar, with zinc and hydrochloric acid (spirits of salt will do). A dirty chalk-like precipitate is accumulated, and the clear liquor is thrown away. The platinum is precipitated in the mud, and the latter, when enough has accumulated, is sent to the refiners, after being drained from water as much as possible on a linen cloth.

Waste prints, clippings from paper, etc., should be sent as they are, or burnt to an ash in a place free from draught, such as a biscuit tin with a row of holes about half way up. They should not be mixed with the wet residues, as the two require different treatment for the extraction of the metal.

IRON PRINTING PROCESSES.

Ferro-Prussiate Sensitiser.

This ferro prussiate or "blue" paper gives prints of Prussian blue colour from ordinary (brilliant) negatives. From line drawings, plans, etc., it supplies copies in white lines on a blue ground.

A.—Ferric ammonium citrate (green)*	110 grs.	250 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. ferricyanide	40 grs	90 gms.
Water	1 oz.	1,000 c.c.s.

Mix in equal parts, keep in the dark, and filter just before use. The sensitiser is applied with a brush or sponge. The paper is printed until the shadows bronze, and is "developed" simply by soaking in one or two changes of plain water.

Solution for Writing Titles on, removing blue lines from, blue prints, etc.—Potass oxalate, 75 grs per oz., 170 gms. per 1,000 c.c.s.

Brightening the Colour. Blue prints are improved in colour by a final bath of 2½ per cent alum solution, 3 per cent. oxalic acid, or 1 per cent. hydrochloric acid.

The Kallitype Process.

Paper, sensitised as below, is printed to a semi visible image, like platinum paper. It yields prints from black to sepia, according to the developer. If prints are fixed in a mixture of hypo and ammonia, the results appear to be permanent.

SENSITISER.

Ferric oxalate (pure and fresh) 20% sol.	1 oz.
Ferric potass. oxalate, 1 16 sol.	½ oz.
Oxalic-ammonia sol. as below	30 minims
Potass bichromate, 1 16 sol.	4 drops
Silver nitrate ..	36 grs

The oxalic-ammonia solution is —Oxalic acid, 240 grs., ammonia, .880, 100 minims, water, 4 ozs.

* If the ordinary brown citrate be used, the formula should contain 60 grs. (137 gms.), and the ferricyanide should be increased to 50 grs. (137 gms.).

Paper thus sensitised yields prints of full gradation and half-tone from ordinary negatives, such as print well in P.O.P. For flat negatives further bichromate solution may be used in the developer.

DEVELOPERS.

For Black Tones.

Borax	2 ozs.	100 gms.
Rochelle salt	1½ ozs	75 gms
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1%) ..	15-18 drs	90-115 c.c.s.

For Purple Tones

Borax	½ oz	28 gms
Rochelle salt	2 ozs	100 gms
Water	20 oz	1,000 c.c.s.
Potass bichromate sol (1%) ..	15-18 drs	90-115 c.c.s

For Sepia Tones.

Rochelle salt	1 oz	50 gms
Water	20 ozs	1,000 c.c.s.
Potass. bichromate sol (1%) ..	8-10 drs.	50-60 c.c.s.

Prints are allowed to remain in either of the above developers for from 15 to 30 minutes.

For Black Tones

Sodium acetate	3 ozs	150 gms
Water	20	1,000 c.c.s

From this developer prints must be passed into a bath of potass oxalate (15 %) before fixing

FIXING SOLUTION

Hypo	1 oz	200 gms.
Ammonia (0 880)	120 minims	12 c.c.s
Water . . .	20 ozs	1,000 c.c.s

Prints are left in this for at least 10 minutes

Sepia Paper.

This process and the single solution sensitizer given below may be used for printing from ordinary negatives, but the results are deficient in gradation Both are excellent for making duplicates of plans, etc., and give a copy in white lines on a brown ground from an ordinary tracing. This copy may be used as a negative for preparing further "positive" copies

A.—Ferric ammonia citrate (green) .	110 grs.	250 gms.
Water	1 oz	1,000 c.c.s.
B.—Tartaric acid	18 grs.	40 gms
Water	1 oz	1,000 c.c.s.
C.—Silver nitrate	45 grs	100 gms.
Water	1 oz	1,000 c.c.s.
D.—Gelatine	30 grs.	70 gms.
Water	1 oz.	1,000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as

follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time The prints are fixed in 1 : 50 hypo.

One-Solution Sepia Sensitiser.

Silver nitrate	55 grs.	3·5 gms.
Water	4·5 drs.	15-20 c.c.s.

Add ammonia drop by drop just to re-dissolve the white precipitate, and then a little sulphuric (or citric) acid just to remove the odour of ammonia. Then add—

Ferric ammonium citrate (green)	40 grs.	2·5 gms.
Water	6 drs.	25 c.c.s.

This solution keeps in the dark, and is used like the four-solution mixture.

Pellet Process.

The Pellet process is for copies of line drawings only From an ordinary tracing it gives a copy in blue lines on a white ground

A.—	Pure gum arabic	4 ozs.	200 gms.
	Water	20 ozs.	1,000 c.c.s.
B.—	Ferric ammonium citrate ..	10 ozs.	500 gms.
	Water	20 ozs.	1,000 c.c.s.
C.—	Ferric chloride (crystallised) ..	10 ozs.	500 gms.
	Water	20 ozs.	1,000 c.c.s.

Add 8 vols of B then 5 vols of C to 20 vols. of A, in small doses with constant stirring.

The prints are developed on 10 per cent. solution of potass. ferrocyanide and "fixed" in 1 : 25 sulphuric acid (specific gravity 1·84).

The Ferro-Gallic Process.

This process is for line drawings only. It gives a copy, in bluish-black lines on a white ground, from an ordinary tracing.

Gum arabic	60 grs.	135 gms.
Warm water	1 oz.	1,000 c.c.s.

When dissolved add the following in the order given:—

Tartaric acid	8 grs.	18 gms.
Salt	36 grs.	81 gms.
Ferric sulphate	40 grs.	90 gms.
Ferric chloride	60 grs	135 gms.

The developer for the prints is:—Alum and gallic acid, 1 part of each; water, 80 parts.

MOUNTANTS.

Starch Paste.

Pure starch is mixed with a very small proportion of cold water to form a very stiff mass. It should be so stiff that it is stirred with difficulty. Perfectly boiling water is then poured in, about 12 ozs. for every ounce of starch. On stirring, the mixture will jellify without being boiled; but if it does not it is brought to the boil, cooled, the skin taken off, and the paste used on day of making.

Gelatine.

For mounting prints without cockling.

Nelson's No. 1 gelatine ..	..	4 ozs.	50 gms.
Water	..	16 ozs.	200 c.c.s.

Soften the gelatine in the water, liquefy on the water bath, and add a little at a time and stirring rapidly:—

Methylated spirit	..	5 ozs.	60 c.c.s.
Glycerine	..	1 oz.	12 c.c.s.

The mountant is used hot. A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

Dextrine Paste.

Dextrine, best white.. ..	..	2½ lbs.	1,400 gms.
Water at 160° F. .. .	..	64 ozs.	1,720 c.c.s
Oil of wintergreen	..	15 minims	1 c.c.
Oil of cloves	..	15 minims	1 c.c.

Place the water in a vessel standing in a larger vessel of water kept to within 1° of 160° F. Stir in the dextrine slowly, and when it has all dissolved add the two preservative oils, stirring all the time. Then allow to cool, pour into bottles, and cork. Put aside in a cool place for a week or two for the mixture to congeal to a firm white smooth paste.

Starch-Gelatine.

A.—Bermuda arrowroot ..	..	8 ozs	200 gms.
Water	..	4 ozs.	100 c.c.s.
B.—Nelson's No. 1 soft gelatine	..	360 grs.	10 gms.
Water	..	64 ozs.	800 c.c.s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	..	5 ozs.	250 c.c.s.
Carbolic acid (liquid) ..	..	25 minims	3 c.c.s.

This is a good cold paste, which sticks and keeps fairly well.

Liquid Gelatine.

Gelatine	1 oz.	100 gms.
Water	6 ozs.	600 c.c.s.
Chloral hydrate	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat, and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

Gum-Dextrine.

Picked white gum arabic ..	⅛ oz.	65 gms.
Dextrine	2½ ozs.	280 gms.
Liquid ammonia	4 drops	50 c.c.s.
Carbolic acid	1 dr.	15 c.c.s.
Water	8 ozs.	1,000 c.c.s.

The gum is powdered in a mortar and mixed intimately with the dextrine, and rubbed with 2 ozs. of water until a smooth mixture is obtained. The remainder of the water is added, and the whole boiled for 10 minutes. The ammonia and carbolic acid are added when cold. This mountant keeps well for months, and is smooth in working and of great adhesiveness.

Shellac Mountant.

A strong solution of shellac in methylated spirit, or, better, rectified spirit, is thinly applied to both mount and print, and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums etc.

Affixing Paper to Metal.

Tragacanth	3 ozs.	60 gms.
Gum arabic	12 ozs.	240 gms.
Water	50 ozs.	1,000 c.c.s.

or—

Gum arabic	1 oz	100 gms.
Aluminium sulphate	45 grs.	10 gms.
Water	10 ozs.	1,000 c.c.s.

Mounting on Glass (Opalines).

Nelson's No. 2 soft gelatine ..	2 ozs.	30 gms.
Water	20 ozs.	300 c.c.s.

The gelatine is soaked in the water, and liquefied by standing the vessel in hot water. The solution is thinned down until nearly as thin as water. Print and glass are immersed, removed together, and squeegeed together with flat rubber squeegee.

WORKING UP, COLOURING, ETC., PRINTS.

Lubricant for Burnishing Prints.

Powdered Castile soap	.. ..	20 grs.	5 gms.
Alcohol	.. ..	10 ozs.	1,000 c.c.s.

Encaustic Paste.

Purified beeswax	50 parts
Oil of lavender..	30 parts
Benzole..	30 parts
Gum elemi	1 part

BASKETT'S FORMULA.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth and polish.

Preparing Prints for Colouring.

P.O.P.'S AND GLOSSY BROMIDES.

Rub the prints lightly with a tuft of wool slightly moistened with artist's purified ox-gall. If they have been lubricated before burnishing apply previously a little alcohol in the same way.

COLLODION PRINTS.

Fluid extract of quillaia ..	..	1 dr.	5 c.c.s.
Water	..	1 oz.	40 c.c.s.
Alcohol	..	1 oz.	40 c.c.s.

BROMIDES.

For Water Colouring.

Apply ox-gall as directed for P.O.P., or prepare as directed below for pastel work.

For Oil Colouring.

If the surface is clean no preparation is needed; if otherwise give a wash of gum, starch, or gelatine, or prepare with pumice powder. Also light drying oil (from the artists' colourman) may be rubbed over with a tuft of wool or the fingers. It dries in about twenty-four hours, and leaves the surface of the bromide ready for painting.

For working up in pastel or black and white, apply fine pumice powder with a tuft of wool, and *remove* with another piece of wool or a duster.

Fixative for Crayon and Pastel Work.

A.—Mastic	.. ..	24 grs.	1·6 gm.
Amyl acetate	.. .. ..	3 ozs.	85 c.c.s.

Dissolve by agitation, and allow to stand some hours before use.

B.—Celluloid (film clippings free from emulsion will do)	.. ..	7 grs.	0·45 gm.
Amyl acetate	.. .. ..	3 ozs.	85 c.c.s.

Dissolve by agitation Mix when both are clear, and keep in tightly-corked bottle. Apply with spray diffuser.

Colouring Prints with Dyes.

Dissolve the aniline colour (1d packets of dye will do) in a sufficient quantity of water (from ½ to 1 oz. to a 1d. packet), and for glossy prints add a little gum. If the work affects the gloss when finished, rub the print over with a piece of wool slightly moistened with a solution of wax in benzole.

Colouring Prints with Artists' Water Colours.

The following are suitable colours for bromide enlargements, platinum, and carbon prints. The colours in ordinary type are permanent, those in italics are more or less doubtful except under special precautions against exposure. Those marked * are transparent.

*Alizarin Scarlet	*Prussian Blue.	**Hooker's Green, No. 2.*
Flesh Tint, No. 1.	**Brown Pink.*	Terre Verte.
Flesh Tint, No. 2.	*Burnt Sienna.	**Brown Madder.*
Flesh Tint, No. 3	Cadmium Yellow.	*Payne's Grey.*
*Indian Red.	*Chrome Lemon*	Raw Umber.
*Rose Madder.	*Chrome Orange.*	Sepia.
Venetian Red.	*Indian Yellow	**Vandyke Brown.*
Vermilion.	Naples Yellow.	Ivory Black.
*Antwerp Blue.	*Raw Sienna.	Lamp Black.
Cobalt Blue.	Roman Ochre.	Chinese White.
*French Ultramarine	Yellow Ochre.	
Indigo.	*Emerald Green*	

Colours for Air-brush Work.

The following is a list of the most useful colours for air-brush work —

Blanc d'Argent, No 2.	Lamp Black	Ultramarine, Light.
Burnt Sienna.	Light Red.	,, Middle.
Burnt Umber.	Mauve.	,, Deep.
Charcoal Grey.	Naples Yellow	Vandyke Brown.
Chinese White	Neutral Tint.	Vermilion.
Chrome Lemon.	Permanent Crimson.	Yellow Ochre.
Chrome Yellow.	Permanent Green.	Brown Madder.
Chrome Deep.	Permanent Scarlet.	Emerald Oxide of Chromium
Chrome Orange.	Prussian Blue.	Indian Yellow.
Cologne Earth.	Raw Sienna.	Sepia.
Emerald Green.	Raw Umber.	
Indian Red.		

Spotting Bromide Prints.

Mix together Payne's grey and Indian ink (the colour should match that of the film)

Spotting P.O.P. Prints.

Add a little carmine to the above. When mixture is dry on the palette) work in a strong solution of gum arabic, the brush one way only, to avoid making air bells. If the prints are to be enamelled or glazed by stripping after spotting, [illegible] with benzole in which gum dammar has been [illegible] may be used with [illegible] water [illegible]

Colouring from Behind (Crystoleum).

The print (which should [illegible]) is [illegible] a warm solution of—

Hard gelatine	90 grs.	15 gms.
Water	1 oz.	1,000 c.c.s.

containing a little salicylic acid to keep it [illegible] with [illegible] made by mixing [illegible] equal [illegible]

[illegible]

Canada balsam	[illegible]	100 gms.
Solid paraffin	[illegible]	10 gms.
White wax	2 oz.	10 gms.

which is melted, the picture immersed, [illegible] as cool as possible consistent with [illegible]

COLOUR PHOTOGRAPHY.

The following are the [illegible] for the screen-plates freely in the market at the time of sending this portion of the ALMANAC to press (November 1, 1917).

The Autochrome Plate.

SIMPLIFIED METHOD OF DEVELOPMENT.

Two solutions only are used: developer (used also for re-development) and reversing solution. There is no need to [illegible]

Developer Stock Solution

A.—Water, distilled	35 ozs.	1,000 c.c.s.
Metoquinone (Quinomet)	½ oz.	15 gms.
Soda sulphite, anhydrous	3½ ozs.	100 gms.
Liquor ammonia, ·920	9 drams	32 c.c.s.
Potass. bromide	90 grs.	6 gms.

Dissolve the Quinomet in warm water (about 100° F.), add the sulphite, and then, when cold, the ammonia.

Working developer: Stock solution, above, 1 part; water, 4 parts.

For correct exposure, time of development is 2¼ minutes exactly; then rinse and immerse in reversing solution, C below.

Where exposure may not be correct, it is best to develop by the following table, allowing of errors being compensated for:—

For half-plate, place in developing dish.

C.D.—Stock solution, A above	85 minims	5 c.c.s.
Water	2¾ ozs.	80 c.c.s.

Have ready in one measure glass—

Stock solution, A above	½ oz.	15 c.c.s

and in another

Stock solution, A above	1½ ozs.	45 c.c.s.

These are placed near the lamp, one or the other quantity of the developer being quickly added to that in the dish, according as the plate comes up quickly or slowly.

Immerse the plate in solution CD, and count the number of seconds elapsing before the first outlines of the image appear (disregarding the sky) by looking at the plate rapidly without taking it out of the dish. Immediately these outlines are discernible, pour into the dish either 15 c.c.s. (½ oz.), or 45 c.c.s. (1½ oz.) of A, whichever may be necessary according to the following table, continuing to count the seconds:—

Appearance of outlines of image (disregarding sky) after immersion.		Quantity of developer A to add on appearance of first outlines	Total duration of development from immersion of plate.	
	Seconds.		Minutes.	Seconds.
	12 to 14	15 c.c.s. (½ oz.)	1	15
	15 to 17	do. do.	1	45
	18 to 21	do. do.	2	15
	22 to 27	do. do.	3	0
	28 to 33	do. do.	3	30
	34 to 39	do do.	4	30
Extreme under exposure	40 to 47	45 c.c. (1½ ozs.)	3	0
	Above 47	45 c.c. (1½ ozs.)	4	0

For a quarter-plate use one-half the above quantities.

Reversing Solution

C.—Potassium permanganate	30 grs.	2 gms.
Sulphuric acid	3 drams	10 c.c.s.
Water	35 ozs.	1,000 c.c.s.

This solution will keep for a short time, but should not be used if cloudy.

Immediately the plate is covered by the C solution daylight may be used. After 3 or 4 minutes, wash for 30 seconds in running water.

In summer it is well to put the plate, after leaving the C bath, for 2 minutes into a solution of chrome alum, as follows:—

Chrome alum	150 grs.	10 gms.
Water	35 ozs.	1,000 c.c.s.

The plate should be rinsed before placing in the second developer, or, if desired, it may be dried and re-developed after a day or two.

Second Development.—The plate is then re-developed in full daylight, using the solution which has served for the first development (kept in the dish without special precautions). When the high-lights are completely darkened (about 3 or 4 minutes) the plate is washed for 3 or 4 minutes, and immediately placed to dry. Fixing is unnecessary unless the plate is intensified.

The Paget Plate.

DUPLICATING METHOD.

A separate panchromatic plate is exposed behind and in contact with a mosaic three colour taking screen, developed, fixed, washed and dried. From it a positive transparency is printed by contact. The transparency is then bound up in register with a mosaic three colour viewing screen.

EXPOSURE.

The following particulars are given as a rough guide.

Open landscape, in good light with sunshine, stop f/8, cap off and on, or about ½ of a second.

Portraiture, head and shoulders only; in diffused light out of doors, stop f/8, about 3 seconds.

Instantaneous exposures should not be attempted except in the brightest light, and never with a smaller stop than f/6·5, under which conditions the exposure may be about 1/10th of a second.

Actinometers are a reliable means of calculating the exposure, and the following speed numbers will be found correct:—

Watkins	Wynne
15	F24

These numbers represent the speed of the panchromatic plate with filter and taking screen in position ready for exposure.

DEVELOPMENT OF NEGATIVES.

The following developer may be used for developing the negative for the Paget Colour Process:—

A.	Pyro	¼ oz.	12.5 gms.
	Potassium metabisulphite ..	10 grs.	1.1 "
	Water to	20 oz.	1,000 ccs.
B.	Soda carbonate (cryst) ..	2 ozs.	100 gms.
	Soda sulphite (cryst) ..	2 "	100 "
	Potassium bromide	10 grs.	1.1 gms.
	Water to	20 ozs.	1,000 ccs.

For use take 1 part each A. and B. and 2 parts of water (making four parts in all) and develop for two minutes.

Paget Colour Developer is to be used according to the instructions on the bottle, but Rytol or any other developer may be used at half the usual strength and taking care not to obtain a hard negative.

Unless a green safelight is used development must take place in total darkness. On no account should a red light or one of any colour other than the safe green be used.

Rinse the plate and fix in the following bath:—

Hypo	6 ozs.
Potass. metabisulphite	½ oz.
Water	20 ozs.

Wash again for about 15 minutes, and put to dry.

MAKING THE TRANSPARENCY.

To obtain the best results the following conditions must be observed:—The transparency should be of black tone, perfectly clear, and free from fog, brilliant and full of detail These conditions can be secured by using the special transparency plates and developer issued in connection with the process.

REGISTERING TRANSPARENCY WITH VIEWING SCREEN

Standing well back in the room, facing the light, the operator holds the two plates together, film to film, the screen being towards him. The latter is then moved very slightly in a circular direction (the transparency being held rigid) until small squares are seen. The same circular direction being maintained the squares will grow larger until they disappear and patches of colour take their place. Continue the movement until a perfectly even tint (it does not matter of what colour) appears all over the transparency. The squares of the screen are now parallel with those of the transparency, and the slightest movement of the screen one way will give the picture in its correct colours. To determine the right direction the operator, still holding the screen and transparency tightly together, should turn them in a slanting position, viewing them from either the top, bottom, right or left, when from one of these points the correct colours will be seen. The screen should be moved very gently in this direction, when the proper colours will gradually appear. Clip the two together with a couple of bull-dog paper clips and bind them securely.

Binding must be carefully done, so as not to alter the position of the screen. Denison's binding strips will be found the best. Bind the two sides not clipped and see that the binding strip is adhering everywhere; then remove one clip at a time (the transparency should never be without one clip) and clip the sides already bound before binding the remaining two. Leave the clips in position until the binding is perfectly dry.

The viewing screens will register one way only, always lengthways of the plate. Therefore, if it is desired to take a portion of the picture from a large negative, say a quarter plate size from a half plate negative, the quarter plate transparency must be made lengthways of the negative and not across.

In the case of square cut plates such as $3\frac{1}{4} \times 3\frac{1}{4}$ a line will be found on the edge of the viewing screen showing the "lengthways" of the plate.

MISCELLANEOUS FORMULÆ.

Reversed Negatives by Ammonium Persulphate.

A lantern or other thinly coated slow plate is placed in contact with the negative in a printing frame and a full exposure given such as would be thought advisable in making a soft positive transparency. The plate is developed with a clean working developer (*e.g.*, glycin) until the shadows appear quite black on the glass side of the plate. The time of development may be five times as long as for an ordinary transparency. The latter is then washed and placed in a 2 per cent. solution of ammonium persulphate until the silver image is seen to be removed. The plate is then thoroughly washed and developed in any clean developer containing about half a grain of bromide per ounce. It is then fixed and washed and dried. After the first development the operations may be done in weak daylight or artificial light. The action of the persulphate should be as complete as possible, otherwise a veil is left over the negative The above is a very rapid and economical process Direct positives, but reversed from right to left, from engravings, etc., may be made in the camera by substituting bromide paper for the plate The exposure should be full and the development as above. The method has this advantage, that the lines are rendered in the same degrees of black and grey as in the original, a point of some importance, since the lines in an engraving are seldom, if ever, of uniform blackness.

To Recover Fogged (Sensitive) Dry-Plates.

Soak for 15 minutes in the following bath contained in a porcelain tank. –

Potass. bichromate ..	¼ oz.	12.5 gms.
Ammonium bromide	¼ oz.	12.5 gms.
Water	20 ozs.	1,000 c.c.s

Wash for 30 minutes, wipe with a pad of cotton wool and stand aside—of course in the dark or by deep ruby light—to dry.

Backing Dry Plates.

Gum solution (ordinary office gum)	1 oz	100 c.c.s.
Caramel	1 oz.	100 gms.
Burnt sienna, ground in water	2 ozs.	200 gms.
Mix and add –		
Alcohol	2 ozs (fl.)	200 c.c.s.

The Dusting-on Process.

Best gum arabic	80 grs.	5·2 gms.
White sugar	60 grs.	4 0 gms.
Ammonium bichromate	60 grs.	4·0 gms.
Water	7 ozs.	200 c.c.s.
Methylated spirit	1 oz.	30 c.c.s.

This mixture will keep for a few days only, and after the plate has

been coated and exposed it is developed with finest graphite powder collodionised, and washed.

Ink for Rubber Stamps.

Aniline red (violet)	.. ..	900 grs.	210 gms.
Boiling distilled water	.. ..	10 oz.	1,000 c.c.s.
Glycerine ..	.. .. about	½ oz	60 c.c.s.
Treacle ..	.. .. about	¼ oz.	30 c.c.s.

Invisible Ink.

Chloride of cobalt..	.. ..	25 grs.	60 gms.
Distilled water ..	.. ..	1 oz. (fl.)	1,000 c c s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming the writing turns blue.

Dead Black for Wood.

Borax	..	30 grs.	8 gms.
Glycerine	..	30 minims	8 c.c.s.
Shellac	..	60 grs.	16 gms.
Water	..	8 ozs	1,000 c.c.s.
Boil till dissolved and add –			
Nigrosine, W.S.	..	60 grs.	16 gms.
Or paint the wood first with – –			
Cupric chloride	..	75 grs.	75 gms.
Potass. bichromate ..	..	75 grs.	75 gms.
Water	..	2¼ ozs.	1,000 c.c.s.
and as soon as the surface dries apply—			
Aniline hydrochloride ..	..	150 grs.	150 gms.
Water	..	2¼ ozs.	1,000 c.c.s.

and wipe off any yellow powder that forms Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterproofing Solution for Wood.

Asphalt	..	4 ozs.	400 gms.
Pure rubber	..	30 grs.	6 gms.
Mineral naphtha	..	10 ozs.	1,000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each. The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil..	..	20 ozs	400 c.c.s.
Spirits of camphor ..	..	2 ozs.	40 c.c.s.
Vinegar	..	4 ozs.	80 c.c.s.
Butter of antimony ..	..	1 oz.	20 gms.
Liquid ammonia	..	¼ oz.	5 c.c.s.
Water	..	¼ oz.	5 c.c.s.

This mixture is applied very sparingly with a bit of old flannel, and thoroughly rubbed off with soft rags.

Blackening Brass Work.

Copper nitrate	200 grs.	450 gms.
Water	1 oz.	1,000 c.c.s.

Place the brass work (perfectly cleaned) in the solution for a few moments, heating it on removal.

Varnish for Brass Work.

Celluloid	10 grs.	4 gms.
Amyl alcohol	½ oz.	100 c.c.s.
Acetone	½ oz.	100 c.c.s.

Instead of this cold celluloid varnish, commercial "cold lacquer" can be used.

To Blacken Aluminium.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in—

Ferrous sulphate	1 oz.	80 gms.
White arsenic	1 oz.	80 gms.
Hydrochloric acid	12 ozs.	1,000 c.c.s.
Dissolve and add—		
Water	12 ozs.	1,000 c.c.s.

When the colour is deep enough dry off with fine sawdust, and lacquer.

Silvering Mirrors (Martin's Method).

(In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.)

A.—Nitrate of silver	175 grs.	40 gms.
Distilled water	10 ozs.	1,000 c.c.s.
B.—Nitrate of ammonium	262 grs.	60 gms.
Distilled water	10 ozs.	1,000 c.c.s.
C.—*Pure* caustic potash	1 oz.	100 gms.
Distilled water	10 ozs.	1,000 c.c.s.
D.—Pure sugar candy	½ oz. (avoir.)	100 gms.
Distilled water	5 ozs.	1,000 c.c.s.
Dissolve and add—		
Tartaric acid	50 grs.	23 gms.
Boil in flask for ten minutes, and when cool add—		
Alcohol	1 oz.	200 c.c.s.
Distilled water, *quant. suff.* to make up to 10 ozs. or 2,000 c.c.s.		

For use take equal parts of A and B Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downwards in the solution.

MISCELLANEOUS INFORMATION.

List of the Principal Works on Photography.

[The books mentioned below are obtainable by order of all photographic dealers.]

ELEMENTARY AND GENERAL TEXT-BOOKS.

Amateur Photography. By F. T. Beeson and A. Williams. 1s.
Ilford Manual of Photography. By C. H. Bothamley. 1s.
Sinclair Handbook of Photography. 1s. 6d.
Barnet Book of Photography. 1s. 6d.
A Primer of Photography. By Captain Owen Wheeler. 2s. 6d
Early Work in Photography. By W. Ethelbert Henry. 1s. 6d.
Photographic Reference Book. By J. McIntosh. 1s. 6d
The Science and Practice of Photography. By Chapman Jones 5s.
Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7s. 6d.
Dictionary of Photography. By E. J. Wall. 7s. 6d.
Cyclopædia of Photography. Edited by Bernard E. Jones. 10s. 6d.
The Complete Photographer. By R. Child Bayley. 10s. 6d.
Photography: Principles and Applications. By Alfred Watkins. 6s.
Photography in Principle and Practice By S. E. Bottomley. 3s. 6d.
Photography of To-day. By H. Chapman Jones 5s.

COPYRIGHT AND PRESS PHOTOGRAPHY.

Photographic Copyright. By George E. Brown, F.I.C., and Alexander Mackie. 1s.
Photographs for the Papers. By John Everard. 1s.

PHOTOGRAPHIC OPTICS AND CHEMISTRY.

Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2s.

Photographic Lenses. By Conrad Beck and Herbert Andrews. 1s.

The Lens. By Thos. Bolas and George E. Brown. 3s.

The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3s. 6d.

System of Applied Optics. By H. Dennis Taylor. 30s.

Photographic Optics, a Treatise On. By R. S. Cole. 6s.

Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6s.

First Book of the Lens. By C. Welborne Piper. 3s.

Lens Facts You Should Know. (No. 140 of "The Photo Miniature.")

Optical Notions for Photographers. (No. 153 of "The Photo Miniature.")

Modern Telephotography. By Captain Owen Wheeler. 1s. 6d.

Telephotography. By C. F. Lan Davis. 1s.

Lens-work for Amateurs. By Henry Orford. 3s.

Chemistry for Photographers. By Charles F. Townsend, F.C.S. 1s. 6d.

The Chemistry of Photography. By R. Meldola. 6s.

Photographic Chemicals. By W. Taylor. 1s.

Investigations on the Photographic Process. By S. E. Sheppard, D.Sc., and C. E. Kenneth Mees, D.Sc. 6s. 6d.

ART, PORTRAITURE, HAND-CAMERA WORK, ETC.

Appeal of the Picture. By F. C. Tilney. 6s.

Posing the Figure. (No. 156 of "The Photo Miniature.")

Lighting in Portraiture. (No. 157 of "The Photo Miniature.")

Picture-making by Photography. By H. P. Robinson. 3s.

Photography on Tour. 6d.

Correct Exposure. (No. 105 of "The Photo Miniature.")

Practical Landscape Photography. By G. T. Harris. 1s.

The Portrait Studio. By "Practicus," of the "B. J." 6d.

Sketch Portraiture. By R. Spencer Adamson. 7d.

The Photographic Studio. A guide to its construction, etc. By T. Bolas. 2s.

Lighting in Photographic Studios. By P. C. Duchochois. Revised, with additional matter, by W. Ethelbert Henry, C.E. 1s.

The Studio, and what to do in it. By H. P. Robinson. 2s. 6d.

Practical Professional Photography. Vols. I. and II. By C. H. Hewitt. 1s. per vol.

Commercial Photography. By "Practicus." 1s.

Hand-Cameras. By R. Child Bayley. 1s. 6d.

Magnesium Light Photography By F. J. Mortimer. 1s. 6d.

Reflex Cameras. (No. 151 of "The Photo-Miniature.")

Photography of Moving Objects and Hand-camera Work for Advanced Workers. By Adolphe Abrahams 1s. 6d.

Instantaneous Photography. By Sir William Abney. 1s.

Copying Methods. (No. 156 of "The Photo-Miniature.")

Panoramic Photography. (No. 73 of "The Photo-Miniature.")

Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2s.

Stereoscopic Photography (No 98 of "The Photo-Miniature.")

Photo micrography. By E. J. Spitta. 12s.

Handbook of Photo-micrography. By H. Lloyd Hind and W. Brough Randles 7s. 6d

Negative Processes

The Wet Collodion Process. By Arthur Payne. 3s.

Collodion Emulsion By H. O Klein 5s.

Practical Orthochromatic Photography By Arthur Payne. 1s.

The Photography of Coloured Objects By C. E. Kenneth Mees, D Sc. 1s.

Negative-making. By Sir William Abney, F.R.S. 1s.

The Watkins Manual (of exposure and development). By Alfred Watkins. 1s. 3d.

Photography by Rule. By J. Sterry. 1s.

Remedies for Defective Negatives (No 143 of "The Photo-Miniature.")

Art of Retouching Negatives, and Finishing and Colouring Photographs. By T S. Bruce and Alfred Braithwaite. 2s. 6d.

Printing Processes.

Art and Practice of Silver Printing. By Sir William Abney and H. P. Robinson. 2s. 6d.

Toning Bromide Prints. By R. Blake Smith. 1s.

Toning Bromides. By C. W. Somerville. 1s. 6d.

Photographic Enlarging. By R. Child Bayley. 1s. 6d.

Enlarging on Development (Gaslight) and Bromide Papers (No. 144 of "The Photo-Miniature.")

A B C Guide to Autotype Permanent Photography. By J. R. Sawyer. 1s.

Carbon Printing. By E. J. Wall. 1s. 6d.

Ozobrome, Science and Practice. By Thomas Manly. 1s.

Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1s. 6d.

Oil and Bromoil Printing. (No 106 of "The Photo-Miniature.")
Platinotype Printing By A. Horsley Hinton. 1s. 6d.
Photographic Reproduction Processes. By P. C. Duchochois. A treatise on photographic impressions without silver salts. 2s. 6d.
Photographic Enamels. By René d'Heliecourt. 2s. 6d.
Trimming, Mounting, and Framing. (No 102 of "The Photo-Miniature")

LANTERNS AND LANTERN SLIDES: CINEMATOGRAPH.

Modern Magic Lanterns. By R. Child Bayley. 1s.
The Lantern, and How to Use It. By Goodwin Norton 1s 6d.
Practical Slide-making. By G. T. Harris 1s
Living Pictures. By H. V. Hopwood 6s
The Guide to Kinematography. By Colin N Bennett 5s 6d.
The Modern Bioscope Operator 3s 6d.

PHOTO-MECHANICAL PROCESSES, ETC

Horgan's Half-tone and Photo-mechanical Processes By S. H. Horgan. 12s. 6d.
Half-tone Process, The By Julius Verfasser. 7s 6d
Half-tone process on the American Basis. By Wm Cronenberg. 2s.
A Treatise on Photogravure in Intaglio. By the Talbot Klic process. By Herbert Denison. 4s 6d.
Photo-Mechanical Processes. By W. T. Wilkinson. 4s.
X-rays Simply Explained. By R. P Howgrave Graham. 6d.

COLOUR PHOTOGRAPHY.

Photography in Colours. By Dr Lindsay Johnson 4s. 6d.
Three-colour Photography. By Baron von Hübl. Translated by H. O. Klein. 7s. 6d.
Natural-colour Photography. By Dr E Konig Translated by E. J. Wall. 2s. 6d

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COPYRIGHT IN PHOTOGRAPHS.

The law of the reproduction of photographs is now governed by the Copyright Act, 1911, which came into force in Great Britain and in some minor British Protectorates on July 1, 1912.

The Copyright (Works of Art) Act, 1862, given in previous editions of the "Almanac," is repealed with the exception of Sections 7 and 8.

The new Act provides protection for all classes of work, both literary and artistic, and is, therefore, a lengthy one, but the chief provisions as to photographs are given below. For a full and adequate, yet simple, treatment of the subject, as far as possible in non-legal language, the reader is referred to "Photographic Copy-

right," written by the Editor of this Almanac in conjunction with Alexander Mackie, hon. secretary of the Professional Photographers' Association, and published by Messrs. H. Greenwood and Co., Ltd., 24, Wellington Street, Strand, London, W.C.2, price 1s. net; free, inland and abroad, 1s. 1d.

Copyright in a photograph lasts for fifty years from the making of the negative. Registration of copyright is abolished.

The copyright belongs to the author unless first made "to the order" of some other person for a valuable consideration, in which case it belongs to the person giving the order.

Photographers can obtain civil remedies (damages, injunctions, etc.) for infringement of copyright; or, where infringement is shown to have been done knowingly, summary remedies (fines and imprisonment) against the infringer.

Infringing copies may be prevented from importation into the United Kingdom by notice to the Customs Commissioners.

Existing copyright photographs (made before July 1, 1912) obtain the full protection of copyright granted by the 1911 Act. They obtain this whether registered or not under the old Act.

The Act provides for copyright in cinematograph films and permits photographs to be taken of copyright architectural works of art (buildings); and also of sculpture which is situated in a public place. Such photographing is not an infringement of the copyright in architecture or sculpture.

In accordance with certain unrepealed clauses of the Copyright Act of 1862 it is an offence against the photographer for his work to be fraudulently issued with a false name or marking, or to be exhibited or sold falsely marked. Copies of photographs may not be issued as having been made by the original author, and a photograph in which unauthorised alterations have been made must not be issued as the unaltered work of the author.

Reproduction Fees

The Copyright Union has drawn attention to the following suggestions drawn up for the guidance of its members by Mr. Alfred Ellis:—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example, a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 ins., when printed with letterpress in one issue of a newspaper; but if it is to be printed as an inset the fee should be at least one guinea. If printed in colours, collotype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertising purposes a higher fee should be charged than for newspaper work. In all cases the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

Makers of Photo-Materials and Booklets issued free by them.

In this list are included, in addition to the names of actual makers, those also of some few sole or general agents, supplying goods under manufacturers' labels. The list does not attempt to include firms supplying unbranded photographic materials.

Plates (other than Lantern) and Films

Austin Edwards
Cadett
Carter
Criterion
Elliott
Gem
Grant
Ilford
Imperial
Kodak
Leto
Marion
Mawson
Paget
Wellington
Wratten

Lantern Plates

Cadett
Elliott
Gem
Grant
Griffin
Ilford
Imperial
Kodak
Leto
Marion
Mawson
Paget
Thomas
Wellington
Wratten

P.O.P., Bromide and Gaslight Papers

Ansco
Cadett
Carter
Criterion
Elliott
Gem
Griffin
Grant
Ilford
Illingworth
Imperial
Kentmere
Kodak
Kosmos
Leto
Marion
Paget
Rajar
Takiris
Wellington

Collodio-Chloride Paper

Grant
Ilford
Kodak
Leto
Marion
Paget
Rajar

Self-Toning Papers.

Criterion
Elliott
Griffin
Ilford
Illingworth
Imperial
Kentmere
Kodak
Leto
Paget
Rajar
Wellington

Platinum Papers

Platinotype Co.

Carbon

Autotype Co.
Elliott
Illingworth
Kentmere

Miscellaneous Printing Papers

Haldon
Marion
Paget

BOOKLETS, ETC., ISSUED GRATUITOUSLY BY THE PHOTOGRAPHIC TRADE.

ADHESIVE DRY-MOUNTING CO. LTD.—All about Dry-mounting.
ALDIS BROS.—Child Portraiture.
AUTOTYPE CO.—First steps in Autotype Printing
" " Trichrome Tissues.
BURROUGHS WELLCOME & CO.—Warm Tones on Gaslight Papers.
" " " " Time Development, Reduction, etc.
CRITERION, LTD.—Topical Films.
ELLIOTT & SONS, LTD.—Perfect Negatives and Prints.
GRANT, THOS. K.—Instructions for use of Autochrome Plates, Lumière Plates, Films, Papers, and Chemicals.
ILFORD LTD.—Ilford Plates. (Exposure, Developing, Intensification, etc.)
" " Every-Day Book of Common Failures Illustrated.
" " Ilford Exposure Tables.
" " Notes on Isochromatism.
" " Printing on P.O.P. and Self-Toning Paper.
" " Bromide and Gaslight Papers.
" " Lantern Slides on Dry Plates.
" " Ilford X-Ray Plates
" " Dry Plates for Process Work.
ILLINGWORTH & CO., LTD.—Tones and Toning.
" " Guide to Photographic Printing (all Processes).
IMPERIAL DRY PLATE CO., LTD.—Imperial Handbook.
" " " " Faults in Negatives.
" " " " The use of Imperial P.O.P.
" " " " Imperial Process Plates.
JOHNSON MATTHEY & CO., LTD.—Economy in Toning.
JOHNSON & SONS.—Correct Development.
KODAK, LTD.—The Velox Book.
" " Kodak Bromide Pictures. By Some Who Make Them.
KOSMOS PHOTOGRAPHICS, LTD.—Kosmos Papers.
LETO PHOTO MATERIALS CO., LTD.—Lantern-Slide Making.
" " " " Perfect Prints (on Self-Toning Paper).
" " " " The Perfect Negative.
" " " " Boardoid Photography.
MARION & CO., LTD.—Marion's Plates and Papers.
" " Northlight Lamp.

MAWSON & SWAN, LTD.—Orthochromatic Photography.
" " " Lantern-Slide Making.
PAGET PRIZE PLATE CO., LTD.—Paget Prize Plates and How to Use Them.
" " " " Paget Panchromatic Plates.
" " " " Paget P.O.P. and How to Use it.
" " " " Exposure Tables for Paget Plates.
" " " " Paget Self-Toning Papers.
" " " " Paget Colour Photography.
PLATINOTYPE CO.—Instructions for Platinotype Printing.
" " Satista and Palladiotype Papers.
RAJAR, LTD.—Working Roll Films.
VANGUARD CO.—Varnishing Negatives.
" " Backgrounds in Negatives.
" " Firelight Portraits.
" " Intensification and Reduction.
WELLINGTON & WARD.—Wellington Photographic Handbook (130 pages).
" " Wellington Plates.
" " Wellington Roll Films.
" " Exposure Tables.
" " Wellington P.O.P.
" " Bromide Printing.
" " Wellington Anti-Screen Plate.
" " Wellington S.C.P. (gaslight paper).
" " Wellington B.B. Paper.
" " Lantern-Slide Making.
" " Wellington X-ray Plates.
WRATTEN DIVISION—KODAK, LTD.—Real Orthochromatism.
" " " Wratten Panchromatic Plates.
" " " Lantern Slides.

TABLES.

WEIGHTS AND MEASURES.

The formulæ in the editorial pages of this ALMANAC are given, in almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula—20 ozs. or 1000 c.c.s. as a rule.

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains, while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims; that is to say, 4375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2·3. Ounces per any given number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the "dry" ("anhydrous") forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

20 Grains = 1 Scruple.
3 Scruples = 1 Drachm = 60 Grains.
8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.
¼ ounce = 109 grains, ½ ounce = 219 grains; ¾ ounce = 328 grains.

3. FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms.
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms.

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0·91 grains.

Metric Weights and Measures.

The unit of weight is the gramme written "gm."; the subdivisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th), the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the terms 0·1 or 0·01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures.—

LINEAR MEASURE.

1 Millimetre (mm.) (1/1000th M.) =	0·03937 inch
1 Centimetre (1/100th M.) .. =	0·3937 ,,
1 Metre (M.) .. .. .. =	39·370113 inches 3·280843 feet 1·0936143 yards
Kilometre (1000 M.) .. .. =	0·62137 mile

SQUARE MEASURE.

1 Square Centimetre .. .. =	0·155 square inch
1 Square Metre (100 square decimetres) .. .. .. =	10·7639 square feet 1·196 square yards

WEIGHT.	*Avoirdupois.*
1 Milligramme (1/1000th gm.) .. =	0·015 grain
1 Gramme (1 gm.) .. .. =	15·432 ,,
1 Kilogramme (1000 gm.) .. =	2·2046223 lbs or 35·273957 ozs.

* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains) but in cases where "drachms" are given the apothecaries' drachm of 60 grains is taken as the unit.

Fluid Measure.

1 Cubic centimetre* (c c) (1/1000th litre) = 16 9 minims
1 Litre (1 L) = 35 ozs. 94 m. = 16894 1 minims

Conversion of Metric into British Measures.

GMS PER LITRE INTO GRAINS PER 10* OZS

The following table gives the most convenient means of translating metric formulæ into British measures

* The figures given in Columns 2, 4, and 6 are a correct translation of the metric proportion when the solution is measured out in ounces and fractions of an ounce If to be measured in minims, the quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drs of water

1 Gms Per Litre	2 Grs. Per 10† ozs	3 Gms Per Litre	4 Grs Per 10† ozs.	4 Ozs Grs Per 10† ozs.		5 Gms. Per Litre.	6 Grs Per 10† ozs.	6 Ozs Grs Per 10† ozs.
1	4 4	30	131	¼	22	155	678	1¼ 22
2	8 8	35	153	¼	44	160	700	1¼—44
3	13 1	40	175	¼	66	165	722	1¼—66
4	17 5	45	197	¼	88	170	744	1¼—88
5	21 9	50	219	½	0	175	766	1½ 0
6	26 2	55	241	½	22	180	788	1½—22
7	30 6	60	262	½	43	185	809	1½—43
8	35 0	65	284	½	65	190	831	1½—65
9	39 4	70	306	½	87	195	853	1½—87
10	43 8	75	328	¾	—0	200	875	2
11	48 1	80	350	¾	22	225	984	2¼
12	52 5	85	371	¾	43	250	1 094	2½
13	56 9	90	394	¾	65	275	1 203	2¾
14	61 2	95	415	¾	87	300	1 313	3
15	65 6	100	437	1	0	325	1,422	3¼
16	70 0	105	459	1	—22	350	1,531	3½
17	74 4	110	481	1	—44	375	1,641	3¾
18	78 8	115	503	1	— 66	400	1,750	4
19	83 1	120	525	[illegible]	88	425	1,859	4¼
20	87 5	125	547	1¼	—0	450	1,969	4½
21	91 9	130	569	1¼	—22	475	2,078	4¾
22	96 2	135	591	1¼	—44	500	2,187	5
23	100 6	140	613	1¼	—66			
24	105 0	145	634	1¼	87			
25	109 4	150	656	1½	—0			

† N B —Quantities in Columns 2, 4, and 6 are dissolved in 9 ozs 2 drs when solutions are to be measured out in minims.

* *Millilitre and C C* Revisions of metric standards have shown that the litre is not exactly 1000 c c s, but 999 84 c c (according to Mendeleeff's calculations from the experimental data) The difference appears sufficiently serious in official circles to warrant the abandonment of the term ' cubic centimetre,' and the employment of "millilitre" for the true thousandth part millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c c from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible, not more than 4 drops in 35 ozs.

GRAMMES INTO GRAINS AND OUNCES (AVOIRDUPOIS).

Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.
0·1		1·5	16		28·1	130	4½	37
0·2		3·1	17	½	43·5	140	4¾	82
0·3		4·6	18	½	59·0	150	5¼	18
0·4		6·2	19	½	74·4	160	5½	61
0·5		7·7	20	½	89·8	170	6	0
0·6		9·1	25	¾	57·0	175	6	76
0·7		10·8	30	1	25	180	6¼	44
0·8		12·4	35	1	103	190	6½	88
0·9		13·9	40	1¼	71	200	7	24
1		15·4	45	1½	38	250	8¾	32
2		30·9	50	1¾	6	300	10½	31
3		46·3	55	1¾	83	350	12¼	41
4		61·7	60	2	51	400	14	50
5		77·2	65	2¼	19	450	15¾	52
6		92·6	70	2¼	94	500	17½	61
7		108·0	75	2½	64	550	19¼	66
8	¼	14·1	80	2¾	32	600	21	70
9	¼	29·5	85	3	0	650	22¾	72
10	¼	44·9	90	3	76	700	24½	81
11	¼	60·4	95	3¼	44	750	26¼	91
12	¼	75·8	100	3½	11	800	28	95
13	¼	91·2	110	3¾	56	850	29¾	102
14	¼	106·7	120	4	102	900	31½	106
15	½	12·7	125	4¼	70	1000	35¼	11

Note.—In the above table the British equivalents are given in the form most convenient for actual work, viz., in even ounces and quarter ounces, with odd grains over. If calculations need to be made, the following figures giving the equivalents of ounces and quarter-ounces in grains will be found useful:—

¼ oz. = 109 grs.	1¾ oz. = 765 grs.	3¼ ozs. = 1,421 grs.	4¾ ozs. = 2,078 grs.
½ oz. = 219 grs.	2 ozs. = 875 grs.	3½ ozs. = 1,531 grs.	5¼ ozs. = 2,296 grs.
¾ oz. = 328 grs.	2¼ ozs. = 984 grs.	3¾ ozs. = 1,640 grs.	5½ ozs. = 2,406 grs.
1 oz. = 437 grs.	2½ ozs. = 1,094 grs.	4 ozs. = 1,750 grs.	6 ozs. = 2,625 grs.
1¼ ozs. = 546 grs.	2¾ ozs. = 1,203 grs.	4¼ ozs. = 1,859 grs.	6¼ ozs. = 2,734 grs.
1½ ozs. = 656 grs.	3 ozs. = 1,312 grs.	4½ ozs. = 1,969 grs.	6½ ozs. = 2,844 grs.

C.C.S. INTO MINIMS AND OUNCES (FLUID).

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s	Ozs.	Mins.
1		16·9	6		101·4	11	¼	66
2		33·8	7		118·3	12	¼	83
3		50·7	8	¼	15·2	13	¼	100
4		67·6	9	¼	32	14	¼	117
5		84·5	10	¼	49	15	½	13

C.C.S. INTO MINIMS AND OUNCES (FLUID).—*Continued.*

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.
16	½	30	120	4	107	500	17½	47
17	½	47	125	4¼	72	525	18¼	110
18	½	64	130	4½	36	550	19¼	52
19	½	81	140	4¾	85	575	20	114
20	½	98	150	5¼	14	600	21	56
25	¾	82	160	5½	63	625	22	0
30	1	27	170	5¾	112	650	22¾	61
35	1	111	175	6	76	675	23¾	4
40	1¼	76	180	6¼	41	700	24½	66
45	1½	40	190	6½	90	725	25½	8
50	1¾	5	200	7	20	750	26¼	70
55	1¾	89	225	7¾	81	775	27¼	13
60	2	54	250	8¾	24	800	28	75
65	2¼	18	275	9½	86	825	29	18
70	2¼	103	300	10½	28	850	29¾	80
75	2½	67	325	11¼	90	875	30¾	22
80	2¾	32	350	12¼	33	900	31½	65
85	2¾	116	375	13	95	925	32½	27
90	3	81	400	14	37	950	33¼	90
95	3¼	45	425	14¾	100	975	34¼	32
100	3½	10	450	15¾	42	1000	35	94
110	3¾	58	475	16½	105			

Conversion of British into Metric Measures.

GRAINS INTO GRAMMES.

Grs.	Gms.	Grs.	Gms.	Grs.	Gms.
1	0·065	16	1·037	35	2·268
2	0·13	17	1·102	40	2·592
3	0·194	18	1·166	45	2·916
4	0·259	19	1·232	50	3·240
5	0·324	20	1·296	55	3·564
6	0·389	21	1·361	60	3·888
7	0·454	22	1·426	65	4·212
8	0·518	23	1·490	70	4·536
9	0·583	24	1·555	75	4·860
10	0·648	25	1·620	80	5·184
11	0·713	26	1·685	85	5·508
12	0·775	27	1·750	90	5·832
13	0·842	28	1·814	95	6·156
14	0·907	29	1·880	100	6·480
15	0·972	30	1·944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Ozs.	Gms.	Ozs.	Gms.	Ozs.	Gms.
¼	7·09	4	113·40	13	368·54
½	14·17	5	141·75	14	396·89
¾	21·26	6	170·10	15	425 24
1	28·35	7	198 45	16	453·59
1½	42·5	8	226 80	17	481·94
2	56·70	9	255·15	18	510 29
2½	70·87	11	311·8	19	538 64
3	85·05	12	340·19	20	566·99

FLUID OUNCES AND DRACHMS TO C.C.S.

Minims.	C.c.s.	Drs.	C.c.s.	Ozs.	C.c.s.	Ozs.	C.c.s.
5 =	·3	½	1·78	1½	42 6	11	312·5
10 =	·6	1	3 55	2	56 8	12	341·0
15 =	·9	2	7 10	3	85 2	13	369·3
20 =	1·2	3	10 65	4	113·6	14	398 0
25 =	1·4	4	14·20	5	142 0	15	426·0
		5	17·75	6	170 5	16	454·5
		6	21·30	7	198 9	17	483·0
		7	24·86	8	227 3	18	511·5
		8	28 41	9	255·7	19	540·0
				10	284 0	20	568·0

CONVERSION RULES

Grammes per litre into grains per ounce.—Multiply the grammes by 0·44.

C.c.s. per litre into minims per ounce.—Divide the c.c.s. by 2 (more exactly, multiply by 0·48).

Grains per ounce into grammes per litre.—Multiply the grains by 2·3. Thus 50 grs. per oz. = 115 gms. per litre.

Minims per ounce into c.c.s. per litre.—Multiply the minims by 2.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., $436\,^{4}/_{11}$ grains for every 5s. Thus the threepenny bit is 21·8 grs.; a sixpence, 43·6; shilling, 87·2; florin, 175·4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—Three pennies, or five halfpennies, or ten farthings = 1 oz. (avoirdupois).

i.e., the penny = 145·8 grs.; 1 halfpenny, 87·5; and 1 farthing, 43·75 grs.

One sovereign weighs 123·27 grs.; the half-sovereign, 61·63 grs.

¼ oz.	(avoir.)	=	one-halfpenny and one threepenny piece.
½ ,,	,,	=	two halfpennies and a farthing.
1 ,,	,,	=	three pennies (or five halfpennies).
2 ,,	,,	=	six pennies (or ten halfpennies).
4 ,,	,,	=	twelve pennies (or twenty halfpennies).

FRENCH COINS AS METRIC WEIGHTS.

Lord Crawford's table.

	Silver Coins.		*Bronze Coins.*
25 gms.	5 francs	10 gms. ..	10 centimes
10 ,, ...	2 ,,	5 ,, ..	5 ,,
5 ,, ...	1 ,,	2 ,, ..	2 ,,
2½ ,, ...	½ ,, or 50 centimes	1 ,, ..	1 ,,

PARTS.

Formulæ given, as many are, in "parts," may be made up by writing gms. for the solid and c.c.s. for the fluid "parts," and converting them into the British measures by any of the tables in this section. Thus: Adurol, 10 parts; sodium sulphite, 100 parts; water, 1000 parts becomes adurol, 154 grs.; sodium sulphite, 3 ozs. 230 grs.; water, 35 ozs.

INCHES INTO MILLIMETRES.

Inches.	Millimetres.	Inches.	Millimetres.
1	25·4	⅜	9·5
15/16	23·8	11/32	8·7
29/32	23·0	5/16	7·9
⅞	22·2	9/32	7·1
13/16	20·6	¼	6·4
¾	19·1	7/32	5·6
11/16	17·5	3/16	4·8
⅝	15·9	⅛	3·2
9/16	14·3	3/32	2·4
½	12·7	1/16	1·6
7/16	11·1	1/32	0·8

MILLIMETRES INTO INCHES.

Millimetres.	Inches.	Millimetres.	Inches.
0·1	0·0039	13	0·51
0·5	0·015	14	0·55
1	0·04	15	0·59
2	0·08	16	0·63
3	0·12	17	0·67
4	0·16	18	0·71
5	0·20	19	0·75
6	0·24	20	0·79
7	0·28	21	0·83
8	0·31	22	0·87
9	0·35	23	0·90
10	0·39	24	0·94
11	0·43	25	0·98
12	0·47	25·4	1·0

ENGLISH SIZES OF

Inches.	Cm.	I	
3½ × 2½	8·9 × 6·4	7 × 5[3]	17·8 × 12·7
3¼ × 3¼[1]	8·25 × 8·25	8½ × 6½[4]	21·5 × 16·5
4¼ × 3¼[2]	10·8 × 8·25	10 × 8	25·4 × 20·3
5 × 4	12·7 × 10·1	12 × [illegible]	30·4 × 25·4
6½ × 4¾	16·5 × 12·0	15 × [illegible]	38·1 × 30·4

[1] Lantern plat [2] Quarter plate. Half-plate [4] Usual medi size in America Whole plate

CONTINENTAL SIZES OF PLATES IN COMMON USE.

Cm.			
4·5 × 6·0*	1¾ × 2⅜	13 × 21	5·12 × 8·2[illegible]
9 × 12†	3·54 × 4·72	18 × 24	7·08 × 9·44
12 × 16	4·72 × 6·30	24 × 30	9·44 × 11·81
13 × 18‡	5·12 × 7·08	30 × 40	11·81 × 15·75

* Standard size of vest pocket plate camera.
† The standard small size, equivalent to the British quarter-plate.
‡ The standard medium size (British half-plate).

FOREIGN LANTERN SLIDES.

The standard French size for lantern slides is 8 by 8 cm., though many makers prepare slides 3¼ by 3¼. The American size is 4 by 3¼, though some makers use the English quarter-plate (4¼ by 3¼).

CHEMICAL TABLES.

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page [illegible].

Name.	Symbol.	Equiv. Weight
Acetone	$C_3 H_6 O$	58
,, sulphite	$C_3 H_6 OH SO_3 Na$	162
Acid, acetic	$C_2 H_4 O_2$	60
,, benzoic	$C_6 H_5 COOH$	122
,, boric	$H_3 BO_3$	62
,, carbolic	$C_6 H_5 OH$	94
,, chlorochromic	$Cl Cr O_2 OH$	136
,, chromic (anhydride)	$Cr O_3$	100
,, citric	$C_6 H_8 O_7 H_2O$	210
,, dithionic	$H_2 S_2 O_6$	162
,, formic	$H_2 CO_2$	46
,, gallic	$C_6 H_2 (OH)_3 COOH, H_2O$	188
,, hydrobromic	$H Br$	81
,, hydrochloric	$H Cl$	36·5
,, hydrofluoric	$H F$	34
,, lactic	$CH_3 CH (OH) COOH$	90
,, nitric	HNO_3	63
,, oxalic	$H_2 C_2 O_4$	126
,, pentathionic	$H_2 S_5 O_6$	258
,, perchromic	$H Cr O_4$	117
,, phosphoric	$H_3 PO_4$	98
,, picric	$C_6 H_2 (NO_2)_3 OH$	139
,, pyrogallic	$C_6 H_3 (OH)_3$	126
,, salicylic	$C_6 H_4 (OH) COOH$	138
,, sulphuric	$H_2 SO_4$	98
,, sulphurous	$H_2 SO_3$	82
,, tannic	$C_{14} H_{10} O_9$	322
,, tartaric	$C_2 H_2 (OH)_2 (COOH)_2$	150
,, tetrathionic	$H_2 S_4 O_6$	225
,, trithionic	$H_2 S_3 O_6$	194
Adurol*	$C_6 H_3 (OH)_2 Cl$ (or Br)	—
Alcohol (methyl)	$CH_3 OH$	32
,, (ethyl)	$C_2 H_5 OH$	46

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Alum, ammonia	$Al_2(NH_4)_2(SO_4)_4\,24H_2O$	906
" chrome	$Cr_2K_2(SO_4)_4\,24H_2O$	998
" iron ammonia	$Fe_2(NH_4)_2(SO_4)_4\,24H_2O$	964
" potash	$Al_2K_2(SO_4)_4\,24H_2O$	948
Aluminium chloride	$Al_2Cl_6\,12H_2O$	267
" sulphate	$Al_2(SO_4)_3\,16H_2O$	631
" sulphocyanide	$Al_2(CNS)_6$	402
Amidol	$C_6H_3OH(NH_2)_2\,2HCl$	197
Ammonia	NH_3	17
Ammonium bichromate	$(NH_4)_2Cr_2O_7$	252
" bromide	NH_4Br	98
" carbonate	$NH_4HCO_3 + NH_2COONH_4$	—
" chloride	NH_4Cl	53·5
" chromate	$(NH_4)_2CrO_4$	152
" citrate	$(NH_4)_2C_6H_6O_7$	226
" iodide	NH_4I	145
" molybdate	$(NH_4)_6Mo_7O_{24}\,4H_2O$	1236
" nitrate	NH_4NO_3	80
" oxalate	$(NH_4)_2C_2O_4\,H_2O$	142
" persulphate	$(NH_4)_2S_2O_8$	228
" phosphate	$(NH_4)_2HPO_4$	132
" sulphate	$(NH_4)_2SO_4$	132
" sulphide	NH_4HS	51
" sulphocyanide	NH_4CNS	76
" vanadate	NH_4VO_3	117
Amyl, acetate	$C_7H_{14}O_2$	130
" alcohol	$(CH_3)_2CH\,CH_2\,CH_2OH$	88
Aniline	$C_6H_5NH_2$	93
Antimony, sulphide	Sb_2S_3	336
Aurantia	$(C_6H_2(NO_2)_3)_2\,N\,NH_4$	456
Aurine	$C(C_6H_4OH)_2\,C_6H_4O$	290
Barium, bromide	$BaBr_2\,2H_2O$	333
" chloride	$BaCl_2\,2H_2O$	244
" iodide	BaI_2	391
" nitrate	$Ba(NO_3)_2$	261
" peroxide	BaO_2	201
" sulphate	$BaSO_4$	233
Benzole (benzene)	C_6H_6	78
Borax (*see* Sodium borate)		
Bromine	Br	80
Cadmium, bromide	$CdBr_2\,4H_2O$	344
" chloride	$CdCl_2$	183
" iodide	CdI_2	366
Calcium, carbide	CaC_2	64
" carbonate	$CaCO_3$	100
" chloride (cryst.)	$CaCl_2\,6H_2O$	219

TABLE OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT
Calcium, chloride (fused)	$Ca\ Cl_2$	111
,, hypochlorite	$Ca\ (O\ Cl)_2$	153
,, sulphate	$Ca\ SO_4\ 2H_2O$	172
,, hydroxide (slaked)	$Ca\ (OH)_2$	74
Carbon, bisulphide		76
Celloidin	$C_{12}\ H_{16}\ O_6\ (NO_3)_4$	504
Ceric, sulphate	$Ce\ (SO_4)_2\ 4H_2O$	404
Chloral hydrate	$C\ Cl_3\ CH\ (OH)_2$	165·5
Chloroform	$CH\ Cl_3$	119·5
Chrysoidine	$C_6\ H_5$ [illegible] $C_6\ H_3\ (NH_2)_2$	211·7
Cobalt, chloride	$Co\ Cl_2\ 6H_2O$	238
Copper, bromide	$Cu\ Br_2$	223·5
,, chloride	$Cu\ Cl_2\ 2H_2O$	170·5
,, nitrate	$Cu\ (NO_3)_2\ 6H_2O$	357·5
,, sulphate	$Cu\ SO_4\ 5H_2O$	249·5
Cyanine	$C_{29}\ H_{35}\ N_2\ I$	544
Dextrine	$(C_6\ H_{10}\ O_5)\ x.$	
Diamidophenol	$C_6H_3\ OH\ (NH_2)_2$	124
Eosine	Na or K Salt of $C_6H_4(CO)_2O(C_6H\ OH\ X^*)_2$	—
Erythrosine	$C_6\ H_4\ (CO)_2\ O\ (C_6\ H\ OH\ X_2^*)_2$	
Ether	$C_4\ H_{10}\ O$	74
Ferrous and ferric salts (see Iron)		
Formaline	40 % sol. of CH_2O	
Glycerine	$C_3\ H_5\ (OH)_3$	92
Glycin†	$C_6\ H_4\ OH\ NHCH_2\ COOH$	167
Gold, chloride yellow	$H\ Au\ Cl_4\ 4H_2O$	412
,, ,, brown	$H\ Au\ Cl_4$	340
,, ,, potassium	$K\ Au\ Cl_4\ 2H_2O$	414
,, ,, sodium	$Na\ Au\ Cl_4\ 2H_2O$	398
Hydrogen, peroxide	H_2O_2	34
Hydroquinone	$C_6\ H_4\ (OH)_2$	110
Iodine	I	127
Iridious chloride	$Ir\ Cl_3$	299·5
,, tetrachloride	$Ir\ Cl_4$	335
,, potassium ,,	$K_2\ Ir\ Cl_6$	484
,, sodium ,,	$Na_2\ Ir\ Cl_6$	452
IRON.		
Ferric chloride (dry)	$Fe_2\ Cl_6$	325

* The X in these formulæ may be bromine, iodine, or chlorine, which elements in other proportions constitute the various commercial dyes.

† Glycin is γ-oxyphenyl-glycin or γ-oxyphenyl amido-acetic acid.

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol	Equiv. Weight.
Ferric chloride (lump)	$Fe_2 Cl_6 12H_2O$	541
,, **ammonia citrate, brown**	$4 Fe C_6 H_5 O_7 3(NH_4)_3 C_6 H_5 O_7 3Fe (OH)_3$	2030
,, ,, ,, **green**	$5 Fe C_6H_5O_7 2(NH_4)_3 C_6H_5O_7 NH_4C_6H_7O_7 2H_2O$	1956
,, **oxalate**	$Fe_2 (C_2 O_4)_3$	376
,, **ammonium oxalate**	$(NH_4)_3 Fe (C_2 O_4)_3 3H_2O$	428
,, **potassium** ,,	$K_3 Fe (C_2 O_4)_3 3H_2O$	491
,, **sodium** ,,	$Na_6 Fe_2 (C_2O_4)_6 11H_2O$	976
Ferrous, chloride (dry)	$Fe Cl_2$	127
,, ,, **(cryst.)**	$Fe Cl_2 4H_2O$	199
,, **oxalate**	$Fe C_2 O_4 2H_2O$	180
,, **potassium oxalate**	$K_2 Fe (C_2 O_4)_2 H_2O$	328
,, **sulphate**	$Fe SO_4 7H_2O$	278
,, **ammonia sulphate**	$Fe (NH_4)_2 (SO_4)_2 6H_2O$	392
Lead, acetate	$Pb (C_2 H_3 O_2)_2 3H_2O$	379
,, **nitrate**	$Pb (NO_3)_2$	331
Lithia, caustic	$Li OH$	24
Lithium, bromide	$Li Br$	87
,, **carbonate**	$Li_2 CO_3$	74
Lithium, chloride	$Li Cl$ (cryst. has $2H_2O$)	42·5
,, **iodide**	$Li I$	134
Magnesium, chloride	$Mg Cl_2$	95
,, **sulphate**	$Mg SO_4 7H_2O$	246
Manganese, peroxide	$Mn O_2$	87
,, **sulphate**	$Mn SO_4 4H_2O$	225
Mercury	Hg	200
,, **bichloride**	$Hg Cl_2$	271
,, **iodide**	$Hg I_2$	454
,, **potass. iodide (soluble)**	$Hg I_2 2KI$	786
Metol*	$(C_6H_4OH NH CH_3)_2 H_2SO_4$	344
Ortol†	$(C_6H_4 OH NH CH_3)_2 C_6H_4 (OH)_2 p$	234
Palladious chloride	$Pd Cl_2$	177
,, **potassium chloride**	$K_2 Pd Cl_4$	326
Para-amidophenol	$C_6 H_4 NH_2 OH$	109
Phenol (see Acid carbolic)		
Platinum per (or bi)chloride	$H_2 Pt Cl_6 6H_2O$	516·4
Potassium, ammonium chromate	$K NH_4 Cr O_4$	173
,, **bicarbonate**	$K H CO_3$	100
,, **bichromate**	$K_2 Cr_2 O_7$	294
,, **boro-tartrate**	$C_2 H_2 (OH)_2 (CO_2)_2 BOK$	214
,, **bromide**	$K Br$	119
,, **carbonate (dry)**	$K_2 CO_3$	138

* **Metol is the sulphate of mono-methyl-para amido phenol.**

† **Ortol is a mixture of one molecule each of methyl ortho-amido phenol and hydroquinone.**

TABLE OF SYMBOLS, &c.—Continued.

Name.		Symbol.	Equiv. Weight.
Potassium	chlorate	$K\ Cl\ O_3$	122·5
,,	chloride	$K\ Cl$	74·5
,,	chloro-platinite	$K_2Pt\ Cl_4$	413·4
,,	chromate	$K_2\ Cr\ O_4$	194
,,	citrate	$K_3\ C_6\ H_5\ O_7\ H_2O$	342
,,	cyanide	$K\ C\ N$	65
,,	ferricyanide	$K_3\ Fe\ (CN)_6$	329
,,	ferrocyanide	$K_4\ Fe\ (CN)_6\ 3H_2O$	422
,,	hydrate	$K\ HO$	56
,,	iodide	$K\ I$	166
,,	metabisulphite	$K_2\ S_2\ O_5$	222
,,	nitrate	$K\ NO_3$	101
,,	nitrite	$K\ NO_2$	85
,,	oxalate	$K_2\ C_2\ O_4\ H_2O$	184
,,	percarbonate	$K_2\ C_2\ O_6$	198
,,	perchlorate	$K\ Cl\ O_4$	138·5
,,	permanganate	$K_2\ Mn_2O_8$	316
,,	persulphate	$K_2\ S_2\ O_8$	270
,,	sulphate	K_2SO_4	174
,,	sulphocyanide	$K\ C\ N\ S$	97
Pyrocatechin		$C_6\ H_4\ (OH)_2$	110
Rochelle salt		$K\ Na\ C_4\ H_4\ O_6\ 4H_2O$	282
Schlippe's salt (sodium sulphantimoniate)		$Na_3\ Sb\ S_4\ 9H_2O$	479
Silver,	acetate	$Ag\ C_2\ H_3\ O_2$	167
,,	ammonium nitrate	$Ag\ NO_3+2NH_3$	204
,,	bromide	$Ag\ Br$	188
,,	carbonate	$Ag_2\ CO_3$	276
,,	chloride	$Ag\ Cl$	143·5
,,	citrate	$Ag_3\ C_6\ H_5\ O_7$	513
,,	fluoride	$Ag\ F\ 4H_2O$	199
,,	iodide	$Ag\ I$	235
,,	nitrate	$Ag\ NO_3$	170
,,	nitrite	$Ag\ NO_2$	154
,,	oxalate	$Ag_2\ C_2\ O_4$	304
,,	oxide	$Ag_2\ O$	232
,,	phosphate	$Ag_3\ PO_4$	419
,,	sulphate	$Ag_2\ SO_4$	312
,,	sulphide	$Ag_2\ S$	248
,,	tartrate	$Ag_2\ C_4\ H_4\ O_6$	363·4
Sodium,	acetate	$Na\ C_2\ H_3\ O_2\ 3H_2O$	136
,,	,, (fused)	$Na\ C_2\ H_3\ O_2$	102
,,	bicarbonate	$Na\ H\ CO_3$	84
,,	bichromate	$Na_2\ Cr_2\ O_7\ 2H_2O$	298
,,	bisulphite	$Na\ H\ SO_3$	104

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Sodium, borate	$Na_2\ B_4\ O_7\ 10H_2O$	382
,, bromide	$Na\ Br\ 2H_2O$	139
,, carbonate (dry)	$Na_2\ CO_3$	106
,, carbonate (cryst.)	$Na_2\ CO_3\ 10H_2O$	286
,, chloride	$Na\ Cl$	58·5
,, chloro-platinate	$Na_2\ Pt\ Cl_6\ 6H_2O$	560·4
,, citrate	$Na_3\ C_6\ H_5\ O_7\ 5\frac{1}{2}H_2O$	357
,, fluoride	$Na\ F$	42
,, hydrate (caustic)	$Na\ OH$	40
,, hydrosulphite*	$Na\ H\ SO_3$	88
,, hyposulphite†	$Na_2\ S_2\ O_3\ 5H_2O$	248
,, iodide	$Na\ I$	150
,, nitrate	$Na\ NO_3$	85
,, nitro-prusside	$Na_4\ Fe_2\ (CN)_{10}\ (NO)_2\ 4H_2O$.	600
,, oxalate	$Na_2\ C_2\ O_4$	134
,, phosphate	$Na_2HPO_4\ 12H_2O$	358
,, tribasic phosphate	$Na_3PO_4\ 12H_2O$	380
,, sulphate (cryst.)	$Na_2\ SO_4\ 10H_2O$	322
,, sulphide	$Na_2\ S\ 9H_2O$	240
,, sulphite (dry)	$Na_2\ SO_3$	126
,, ,, (cryst.)	$Na_2\ SO_3\ 7H_2O$	252
,, tungstate	$Na_{10}\ W_{12}\ O_{41}\ 28H_2O$	3598
Strontium, bromide	$Sr\ Br_2$	247·5
,, chloride (dry)	$Sr\ Cl_2$	158·5
,, ,, (cryst.)	$Sr\ Cl_2\ 2H_2O$	194·5
,, iodide	$Sr\ I_2$	341 5
,, nitrate	$Sr\ (NO_3)_2$	211 5
Thiocarbamide	$CS\ (NH_2)_2$	76
Thiosinamine	$CS\ (NH_2)\ NH\ C_3\ H_5$	116
Thymol	$CH_3\ C_6\ H_3\ OH\ C_3\ H_7$	150
Tin (Stannous) chloride	$Sn\ Cl_2 + 2H_2O$	225
Uranium, acetate	$UO_2\ (C_2\ H_3\ O_2)_2\ 2H_2O$	426
,, chloride	UO_2Cl_2	343
,, nitrate	$UO_2\ (NO_3)_2\ 6H_2O$	504
Zinc, sulphate	$Zn\ SO_4\ 7H_2O$	287

* Called "hyposulphite" by chemists. † Called "thiosulphate" by chemists.

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol. = *soluble*; v.s. = *very soluble*; s.s. = *slightly soluble*; dec. = *decomposed*; insol. = *insoluble*.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Acetone	..	.	..	
,, sulphite	v.s.	..	..	s.s.
Acid, acetic	..	..	..	
,, benzoic	380	45	0 27	1 in 2·75 90%
,, boric	2.)	2 9	34	1 in 28 90%
,, carbolic	15	..	6 6	v.s.
,, chromic (anhydride)	0 6	v.s.	160	sol. with decomp'.
,, citric	¾	½	130	
,, formic	..	..	..	

Acetone.—(Sp. gr. 0 814), boils at 133° F. miscible in all proportions with water, alcohol and ether. 272 gms. dissolve in 100 gms. 20% cane sugar solution at 60° F. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The "glacial" acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50° F. Its sp. gr. is 1·055, it boils at 245 F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1·22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1·20 (90%), 1 18 (80%); 1·15 (65%); 1·12 (50%) and 1·06 (25%).

Hydriodic Acid.—A solution of the gas, HI, and obtainable as strong as sp. gr. 2·0 (=96% HI). Solution of sp. gr. 1.7 contains about 57%; sp. gr. 1.5, about 43%.

Hydrobromic Acid.—A solution of the gas, HBr., in water. The strongest solution has sp. gr. of 1 78 (=82%): sol. of 1·105 sp. gr. contains 48% HBr.; 1 38, 40%, 1·208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl, in water. The commercial strongest acid has sp. gr. 1·16, and contains about 30% HCl. Impure acid is sold as "spirits of salts."

Hydrocyanic Acid (=Prussic Acid).—The strength of the official acid of the British Pharmacopœia is 2%. A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric Acid is a strongly fuming solution of the gas HF.; it is sold of strengths 40% and 55% HF.

Lactic Acid is sold as a colourless syrupy liquid, miscible with water or alcohol, Sp. gr. 1·21. A weaker acid is also sold commercially containing 50% acid.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold	Boiling	100 parts of water dissolve at ordinary temperature	Solubility in Alcohol, &c.
Acid, gallic	100	0·3	[illegible]	1 in 5 90% alcohol, 1 in 40 ether
„ oxalic	9 5	0 3	10[illegible]	
„ picric	100	..	[illegible]	1 in 10 90 %, also in ether
„ pyrogallic	2½	[illegible]	[illegible]	[illegible], also in ether, not in chloroform
„ salicylic	500	1[illegible]	[illegible]	1 in [illegible], 1 in 2 in ether
„ tannic	0 [illegible]	..	[illegible]	1 in 0·6, nearly insol. in ether
„ tartaric	[illegible]	[illegible]	[illegible]	
Alum, ammonia	8·3	0 2[illegible]	[illegible]	insoluble
„ chrome	6	dec	[illegible]	
„ iron ammonia ...	3	d[illegible]	[illegible]	insoluble
„ potash	10	v.[illegible]	9 [illegible]	insoluble
Aluminium, chloride .. .	[illegible]	v s.	400	soluble
„ sulphate .. .	3	1 1	35	
Amidol	4	v.s	[illegible]	less sol. in alc. & eth.
Ammonium, bichromate ..	5	[illegible]	2[illegible]	1 in 51 absolute alc.
„ bromide .. .	1 4	[illegible]	7[illegible]	

Nitric Acid.—Strongly corrosive liquid of 1·42 sp. gr. (= 70 % HNO_3); soluble in water; oxidises alcohol and other organic solvents.

Phosphoric Acid.—Sold as syrupy liquid, that of 1·75 sp. gr. (= about 90 % acid), being intended when "phosphoric acid" is prescribed in formulas.

Sulphuric Acid.—The commercial strong acid is a dense corrosive liquid of 1·84 sp. gr. (= 98%, H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water, not *vice versa.*

Sulphurous Acid.—Solution in water of the gas SO_2; saturated solution of 1·046 is equivalent to 9 5 % H_2SO_3, but soon loses strength.

Albumen.—On heating the cold solution to 160 F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. 0 814).—The chief constituent of crude "wood spirit," or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms "absolute alcohol" (sp. gr. 0 830 to 0 834), which contains from 2 to 5% water. Alcohol containing 16% water is "rectified spirit." "Methylated" spirit consists of rectified spirit *plus* 10% crude wood spirit and ½% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

Aluminium Chloride.—100 gms. saturated solution (sp. gr., 1 35) contains 41·1 gms. aluminium chloride.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Ammonium carbonate ..	4	dec.	25	
„ chloride	3	1·4	35	
„ citrate	½	v.s.	200	
„ iodide	0 6	v.s.	165	1 in 4 alc., s.s in ether
„ molybdate ..	2½	dec.	40	
„ nitrate	½	v.s.	200	
„ oxalate	23	2 4	4·3	sol.
„ persulphate	1½	dec.	65	
„ sulphocyanide	0 6	v.s.	160	v.s.
„ vanadate	s.s.	v.s.	..	
Antimony sulphide	insol	..	..	
Aurantia	s.s.	..	..	v.s.; s.s. in ether
Aurine	s s.	..	..	sol.; also in ether
Barium bromide	0·75	0·5	133	v.s. in benzole
„ chloride	2·4	1·3	42	insol.
„ iodide	½	v.s.	200	1 in 20 alcohol
„ nitrate..........	12	3 1	8	insol.
Bromine................	31	..	3·2	
Cadmium, bromide	0·94	v.s.	106	1 in 3 alc.; 1 in 250 eth.
„ ammonium bromide	0·7	v.s.	137	
„ chloride	0·71	0·67	140	1 in 8 alcohol
„ iodide	1·08	0·75	93	1 in 1 alc.; 1 in 3·6 eth
Calcium, chloride (cryst.)	¼	v.s.	400	
„ „ (fused)	1·4	0·65	70	
„ sulphate	380	450	0 3	
„ hydroxide	700	1,300	0 137	
Ceric sulphate	12	200	8 3	
Chloral hydrate	¼	..	400	1 in 1/5 90%, 1 in 50 carbon bisulphide.
Copper bromide	v.s	v.s.	..	
„ chloride	0·83	v.s.	121	v.s.; also in ether.
„ sulphate	2½	½	40	
Cyanine	s.s.	..	..	
Diamidophenol	sol.	..	..	

Aluminium Sulphocyanide is purchased as a reddish solution of 1·16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also polysulphides.

Amyl Acetate.—Liquid of sp. gr. 0·876, miscible with alcohol and ether but not with water. A solvent of fats, oils, resin, pyroxyline and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water.

Aniline (sp. gr. 1·036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Edinol	sol.	..	..	nearly insol. in alcohol or ether.
Eikonogen	25	..	4·2	
Eosine	sol.	..	..	insol. in ether.
Ether	12	..	8	
Erythrosine	s.s.	..	..	s.s.
Gold, chloride	v.s.	v.s.	..	
Hydroquinone	17	..	6	
Iodine	insol.	insol.	..	sol.; also in carbon bisulphide
Iron				
Ferric chloride (lump)	v.s.	v.s.	..	
,, ,, (dry)	0·63	v.s.	160	
,, ammonium citrate	4	..	25	
,, ,, (brown)*	..	..		
,, ,, (green)†	..	..		
,, ammonium oxalate	2·1	..	0·48	
,, potassium ,,	15	0·85	6·6	insol
,, sodium ,,	1·69	0·55	60	
Ferrous chloride (dry)	2	v.s.	50	
,, ,, (cryst.)	0·68	v.s	147	
,, oxalate	4500	3800	..	
,, sulphate§	1·43	0 27	70	
,, am. sulphate§	3	..	33	
Lead, acetate	$1\frac{1}{2}$	0·5	66	1 in 15 alcohol
Lead, nitrate	2	0 7	50	insol. in ether
Lithia, caustic	s.s.	..	..	
Lithium, bromide	0·7	0·4	143	
,, carbonate	72	138	1·3	v.s.
,, chloride	$1\frac{1}{4}$	0·8	80	
,, iodide	0·61	0·2	164	v.s.
Magnesium, chloride (dry)	1·7	$1\frac{1}{2}$	60	v.s.
,, sulphate	1	0·15	100	
Manganese, sulphate	0·8	1	120	

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F., sp. gr. 0·722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH_2O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolves in the cold by oxalic, acetic, hydrochloric, or nitric acid, barium chloride, or chloral hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1·265

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution.

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212° F.

§ Seven parts of ferrous sulphate correspond to 10 parts ferrous ammonium sulphate. * 21·7 to 22·4% iron. † 14 to 15% iron.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Mercury, bichloride......	16	1·8	6·3	insol. in absolute alc.
„ iodide	150	..	0 66	1 in 4 90%
Metol	sol.	..	..	
Ortol	sol.	..	..	s.s.; also in ether
Para-amido phenol hydro chloride	10	..	10	1 in 22
Phenol (*see* acid carbolic)				
Potassium, bicarbonate .	4	dec.	25	
„ bichromate .	10	1	10	
„ borotartrate.	[illegible]	v.s.	135	
„ bromide	1½	1	65	
„ carbonate(dry)	0 9	0 64	112	1 in 750
„ chlorate	17	2	6	insol.
„ chloride	3	1 75	33	insol.
„ chloroplatinite	6	v s	17	
„ chromate ...	2	1·2	50	insol.
„ citrate	0 6	v.s.	166	insol.
„ cyanide.....	0·8	v s.	122	v.s.
„ ferricyanide..	2½	1 3	40	1 in 9
„ ferrocyanide.	3 4	2	29	
„ hydrate	½	v.s.	200	insol.; insol. in eth.
„ iodide	0·7	½	140	sol.
„ metabisulphite	sol.	dec	..	1 in 16, 90%
„ nitrate	3½	0 4	28	
„ nitrite	1	v s.	100	
„ oxalate	3	v.s.	33	insol.
„ percarbonate	15	dec.	6 5	
„ perchlorate .	100	5	1	
„ permanganate	16	..	6·25	
„ persulphate ..	[illegible]0	dec.	2	
„ sulphocyanide	0 46	v.s.	220	insol in absolute alc.
„ acid sulphate	2	0·8	50	
Pyrocatechin	1¼	v.s.	80	
Rochelle salt	1½	v.s.	66	
Schlippe's salt	3	v.s.	33	
Silver, acetate	100	..	1	
„ carbonate	insol.	..	..	
„ chlorate..........	5	2	20	
„ citrate[1]	insol.	..	..	
„ cyanide	insol.	..	..	
„ fluoride[2]	v.s.	v.s.	..	

1. Readily soluble in ammonia and hypo.
2. $AgF.4H_2O$ is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in parts of water. Cold	Boiling	100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Silver, nitrate	0·44	0 1	227	1 in 26, 90%
,, nitrite	s.s.	..	..	
,, sulphate	87	..	1 15	
,, sulphocyanide	insol.	..	..	
,, tartrate	insol.	..	..	
Sodium, acetate	2·8	v.s.	36	1 in 50, 90%; insol. in [ether
,, bicarbonate ...	11·3	dec.	8 8	
,, bichromate	1	0 6	100	
,, bisulphite	v.s.	..	..	
,, borate	12½	½	8	
,, bromide	1·1	0 9	90	1 in 15
,, carbonate (dry)..	6	2·2	16 2	
,, ,, (cryst.)	1 56	v.s.	[illegible]	
,, chloride	3	2½	[illegible]	
,, chloroplatinate.	sol.	..	.	
,, citrate	sol.	..	.	v.s.
,, fluoride	25	..	4	
,, hydrate (caustic)	v.s.	v.s.	..	
,, hyposulphite ..	0 6	v.s.	170	insol.
,, iodide	0 6	0 4	166	
,, nitrate	1·1	0·6	95	
,, oxalate	35	..		
,, phosphate	6 7	1	[illegible]	
,, sulphide	v.s.	v.s.	.	
,, sulphite (cryst.)	2 2	1	45	
,, ,, (dry) ..	4	..	25	
,, tri-basic phosphate	0 5	v.s.	20	
,, tungstate	8 to 12	..		insol.
,, (meta) vanadate	½	v.s.	200	
Strontium, bromide.... .	1 01	½	100	1 in 30, 90%.
,, chloride.... ..	1 96	1	51	
,, ,, (cryst.)	1 33	0·6	75	
,, iodide	0 56	0 25	18	
,, nitrate	1 41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether
Thiosinamine	17	..	6	1 in 2, 90%; also in eth.
Thymol	330	..	0 3	1 in 3·75, 90%; also in [ether.
Tin (stannous), chloride..	14	v.s	66	
Uranium, acetate.........	v.s.	v.s.	..	
,, chloride	v.s.	v.s.	..	
,, nitrate........	½	v.s.	200	
Zinc, sulphate	0·62	0 15	161	

THERMOMETRIC RULES.

The following rules for the rapid conversion of degrees in one system into another will be found useful:—

To Convert Centigrade into Fahrenheit:

Degrees Centigrade × 9 ÷ 5 + 32.
Ex.—80° C. × 9 ÷ 5 = 144 + 32 = 176° F.

To Convert Fahrenheit into Centigrade:

(Degrees Fahrenheit − 32) × 5 ÷ 9.
Ex.—100° F. − 32 = 68 × 5 ÷ 9 = 37·8 C.

To Convert Fahrenheit into Reaumur:

(Degrees Fahrenheit − 32) ÷ 9 × 4.
Ex.—95° F. − 32 = 63 ÷ 9 × 4 = 28° R.

To Convert Réaumur into Fahrenheit:

Degrees Réaumur × 9 ÷ 4 + 32.
Ex.—16° R. × 9 ÷ 4 = 36 + 32 = 68° F.

To Convert Centigrade into Reaumur:

Degrees Centigrade × 4 ÷ 5.
Ex.—60° C. × 4 ÷ 5 = 48° R.

To Convert Réaumur into Centigrade:

Degrees Réaumur × 5 ÷ 4.
Ex.—80° R. × 5 ÷ 4 = 100° C.

COMPARISON OF THERMOMETER SCALES.

EQUIVALENCE OF CENTIGRADE (CELSIUS) AND FAHRENHEIT THERMOMETERS.

Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
0	32·0	35	95·0	70	158·0
1	33·8	36	96·8	71	159·8
2	35·6	37	98·6	72	161·6
3	37·4	38	100·4	73	163·4
4	39·2	39	102·2	74	165·2
5	41·0	40	104·0	75	167·0
6	42·8	41	105·8	76	168·8
7	44·6	42	107·6	77	170·6
8	46·4	43	109·4	78	172·4
9	48·2	44	111·2	79	174·2
10	50·0	45	113·0	80	176·0
11	51·8	46	114·8	81	177·8
12	53·6	47	116·6	82	179·6
13	55·4	48	118·4	83	181·4
14	57·2	49	120·2	84	183·2
15	59·0	50	122·0	85	185·0
16	60·8	51	123·8	86	186·8
17	62·6	52	125·6	87	188·6
18	64·4	53	127·4	88	190·4
19	66·2	54	129·2	89	192·2
20	68·0	55	131·0	90	194·0
21	69·8	56	132·8	91	195·8
22	71·6	57	134·6	92	197·6
23	73·4	58	136·4	93	199·4
24	75·2	59	138·2	94	201·2
25	77·0	60	140·0	95	203·0
26	78·8	61	141·8	96	204·8
27	80·6	62	143·6	97	206·6
28	82·4	63	145·4	98	208·4
29	84·2	64	147·2	99	210·2
30	86·0	65	149·0	100	212·0
31	87·8	66	150·8	105	221·0
32	89·6	67	152·6	110	230·0
33	91·4	68	154·4	115	239·0
34	93·2	69	156·2	120	248·0

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers	Accurate Atomic Weight.
Aluminium	Al	27	27·1
Antimony	Sb	120	120·2
Argon	A	40	39·9
Arsenic	As	75	75·0
Barium	Ba	137	137·43
Beryllium	Be . Gl	9 1	9 1
Bismuth	Bi	208	208 0
Boron	B	11	11 00
Bromine	Br	80	79 96
Cadmium	Cd	112	112·4
Cæsium	Cs	133	132·9
Calcium	Ca	40	40 1
Carbon	C	12	12 0
Cerium	Ce	140	140 25
Chlorine	Cl	35 5	35 451
Chromium	Cr	52	52 11
Cobalt	Co	59	59 00
Copper	Cu	63 5	63 60
Erbium	Er	166	166 0
Fluorine	F	19	19·0
Gadolinium	Gd	156	156 01
Gallium	Ga	70	70·0
Germanium	Ge	72·5	72 5
Gold	Au	197	197·2
Helium	He	4	4·0
Hydrogen	H	1	1·008
Indium	In	115	115·0
Iodine	I	127	126·97
Iridium	Ir	193	193 0
Iron	Fe	56	55·9
Lanthanum	La	139	138·9
Lead	Pb	207	206 92
Lithium	Li	7	7·03
Magnesium	Mg	24	24·36
Manganese	Mn	55	55·0
Mercury	Hg	200	200·0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight.
Molybdenum	Mo	96	96·0
Neodymium	Nd	144	143·6
Nickel	Ni	59	58·70
Niobium	Nb – Cb	94	94·0
Nitrogen	N	14	14·04
Osmium	Os	191	191·0
Oxygen (Standard)	O	16	16·0
Palladium	Pd	106	106·5
Phosphorus	P	31	31·0
Platinum	Pt	193·4	194·8
Potassium	K	39	39·15
Praseodymium	Pr	141	140·5
Rhodium	Rh	103	103 0
Rubidium	Rb	85	85 5
Ruthenium	Ru	102	101·7
Samarium	Sm	150	150·3
Scandium	Sc	44	44·1
Selenium	Se	79	79·2
Silicon	Si	28	28 4
Silver	Ag	108	107·93
Sodium	Na	23	23 05
Strontium	Sr	87·5	87·6
Sulphur	S	32	32·06
Tantalum	Ta	183	183·0
Tellurium	Te	128	127·6
Terbium	Tb	160	160·0
Thallium	Tl	204	204·1
Thorium	Th	233	232·5
Thulium	Tu	171	171·0
Tin	Sn	118	119·0
Titanium	Ti	48	48·1
Tungsten	W	184	184·0
Uranium	U	240	238·5
Vanadium	V	51	51·4
Ytterbium	Yb	173	173·0
Yttrium	Yt	89	89·0
Zinc	Zn	65	65·4
Zirconium	Zr	91	90·6

TABLE OF POISONS AND ANTIDOTES. Compiled by J. Elsden.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid.	Oxalic Acid, including Potassium Oxalate	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies	Ammonia Potash Soda	Vapour of ammonia may cause inflammation of the lungs	Swelling of tongue, mouth, and fauces: often followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts,	Mercuric Chloride	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	Acetate of Lead	The sub-acetate is still more poisonous	Constriction in the throat and at pit of stomach, crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia. Emetic of sulphate of zinc.
	Cyanide of Potassium	*a.* Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	Bichromate of Potassium	*a.* Taken internally.	Irritant pain in stomach and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	"
	Nitrate of Silver		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	Nitric Acid	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	Hydrochloric Acid	½ ounce has caused death.		
	Sulphuric Acid	1 drachm has been fatal.		
	Acetic Acid, concentrated, has as powerful an effect as the mineral acids.			
	Iodine	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel, arrowroot and starch given freely.
	Ether	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	Pyrogallic Acid	2 grains sufficient to kill a dog.	Resembles phosphorus poisoning.	No certain remedy. Speedy emetic desirable.

EXPOSURE TABLES.

The following table, based on that of Burton, gives a rough idea of the exposures for various subjects and diaphragms under the following conditions:—

1. Best lighting; midday sunshine in May, June, and July.

2. With the most rapid commercial plates. See below for factors applying to other conditions.

F/ No.	Average Subject with objects in Fore-ground. Street Scenes. Outdoor Figure Studies.	Landscapes with Light Foreground, Lake, River, and Beach Scenes.	Sea Clouds and Sky.	Subjects with Extra Heavy Foreground e.g., Dark Trees, Doorways, Groups.	Under Trees, Woods, Avenues, Glades, etc.	Portrait in Average Well-lighted Room.
f/4	1/250	1/500	..	1/120	1/20	1/8
f/4·5	1/200	1/400	..	1/100	1/15	1/7
f/5·6	1/130	1/250	—	1/64	1/10	1/4
f/6·3	1/100	1/200	1/1000	1/50	1/8	1/3
f/7	1/80	1/150	1/800	1/40	1/7	2/5
f/8	1/64	1/120	1/600	1/30	1/5	1/2
f/11	1/30	1/60	1/300	1/15	1/2	1
f/16	1/15	1/30	1/150	1/8	1	2
f/22	1/8	1/15	1/80	1/4	2	4
f/32	1/4	1/8	1/40	1/2	4	8
f/45	1/2	1/4	1/20	1	8	16
f/64	1	1/2	1/10	2	16	30

In weather other than bright sunshine the above exposures are multiplied as follows :—

Bright diffused light, the sun behind a cloud	× 1½	Heavy clouds over the whole sky. Absence of distinct shadows ..	× 3
Light clouds over the whole sky, but light able to cast a visible shadow	× 2	Very dull. Whole sky covered by still heavier clouds	× 4 to 5

At other hours of the day and times of the year the above exposures are multiplied by the numbers in the following table of daylight variation. The figure 1 in the table indicates times for which the above exposures are correct.

VARIATION IN DAYLIGHT FROM MORNING UNTIL EVENING (FOR LATITUDE OF BRITISH ISLES, NORTH GERMANY, ETC.).

	Morning.								
	12	11	10	9	8	7	6	5	4
January	3½	4	5	12					
February ..	2	2½	3	4	10				
March	1½	1½	1¾	2	3	6			
April	1¼	1¼	1¼	1½	2	3	6		
May	1	1	1	1¼	1½	2½	3	6	
June	1	1	1	1	1½	2	2½	5	12
July	1	1	1	1¼	1½	2½	3	6	
August	1¼	1¼	1¼	1½	2	3	6		
September ..	1½	1½	1¾	2	3	6			
October.. ..	2	2½	3	4	10				
November ..	3½	4	5	12					
December ..	4½	5	6						
	12	1	2	3	4	5	6	7	8
	Afternoon.								

MENTAL RULE FOR TELEPHOTO EXPOSURES.

(CAPTAIN OWEN WHEELER.)

Assume that the positive is used at $f/16$. With a meter or by any other means find the exposure required in the ordinary way for stop $f/64$, making due allowance for distance and character of subject. Then multiply the time of exposure thus found by the necessary factor given in the following table for various magnifications.—

For 4 magnifications	×	1		For 10 magnifications	×	6
5	,,	×	$1\frac{1}{2}$	11 ,,	×	7
6	,,	×	2	12 ,,	×	8
7	,,	×	3	13 ,,	×	10
8	,,	×	4	14 ,,	×	12
9	,,	×	5			

If the tele-positive is stopped to $f/11$ or $f/8$ the exposure on which the method is based must be taken as for $f/45$ or $f/32$, as the case may be.

PINHOLE EXPOSURES. (WATKINS-POWER NUMBERS.*)

W.P. No.	Diameter.		Nearest Needle Size.	Good Working Distance.
	Inch.	Inch.		Inches.
1	0·160	$\frac{1}{6}$	–	—
2	0·080	$\frac{1}{13}$	–	—
3	0·053	$\frac{1}{19}$	1	40
4	0·040	$\frac{1}{25}$	4	20
5	0·032	$\frac{1}{31}$	5	14
6	0·027	$\frac{1}{38}$	7	10
7	0·023	$\frac{1}{44}$	8	8
8	0·020	$\frac{1}{50}$	10	5

Rule for use of W.P. No. in Column 1. Multiply W.P. No. of aperture by its working distance from plate. Use the result as the f/No. in calculating exposure by meter, tables or other means. Whatever the calculated result is in seconds or fractions of a second, expose that number of minutes or fractions of a minute. Example.—W.P. 6 at 8 inches—calculate as f/48.

* The principle of this system will be understood from a consideration of an example of focal aperture.—A $\frac{1}{4}$ inch aperture at 9 inches = f/36. If every second on the actinometer is to be reckoned a minute, the aperture must be one-sixtieth the *area*, that is the diameter must be divided by $\sqrt{60}$ or, near enough, by $\sqrt{64} = 8$. Therefore, an aperture of $\frac{1}{4} \div 8 = \frac{1}{32}$ inch diameter = f/36 when minutes are given instead of seconds. Therefore, reasoning backwards, a pinhole of $\frac{1}{32}$-inch diameter is called No. 4 ($32 \div 8$). Similarly one of half the diameter is No. 8, and so on. Mr. Watkins, in order to allow for the exposure in excess of the theoretical which is needed in pinhole photography, calculates minutes as seconds at $\frac{1}{40}$ instead of $\frac{1}{60}$, the *area* of aperture, and therefore his so-called W.P. (Watkins-Power number) is obtained by dividing the denominator of the fraction which expresses the diameter of the pinhole by 6·3 instead of 8. Thus, in the case of a $\frac{1}{38}$-diameter hole, $38 \div 6{\cdot}3 = 6{\cdot}2$, or, near enough, W.P. No. is 6

SHUTTER SPEEDS FOR MOVING OBJECTS.

From the "Wellcome Exposure Record and Diary."

The formula and table given below indicate the shutter speeds necessary to secure negatives sufficiently sharp for direct printing. For enlarging it is better to give $\frac{1}{2}$ to $\frac{1}{3}$ these exposures, or to work further from the object. *The figures are no guide to what is the correct exposure for the plate.*

If D = distance of object in feet, F = focal length of lens, S = speed of object in feet per second, and E = exposure for an object moving across the field of view, then

$$E = \frac{D}{100\,F \times S}\,.$$

The following table gives in round figures the shutter speeds necessary for various moving objects, using the ordinary quarter plate lens of about 5 in. focus. The column A is for objects moving directly towards the operator, B for objects moving obliquely towards or from the camera, that marked C for objects moving directly across the field of view.

Distance of Object, 25 ft., unless otherwise stated.	A.	B.	C.
Street groups (no rapid motion)		1/5 to 1/10	
Pedestrians (two miles per hour) .. } Animals grazing	1/20	1/40	1/60
Pedestrians (three miles per hour) ..	1/30	1/60	1/90
Pedestrians (four miles per hour)	1/40	1/80	1/120
Vehicles (six miles par hour)	1/60	1/120	1/180
Vehicles (eight miles per hour)	1/80	1/150	1/250
Cyclists and trotting horses	1/160	1/300	1/500
Foot races and sports	1/240	1/500	1/700
Divers	—	1/600	1/800
Cycle races, horse galloping	1/300	1/750	1/900
Yachts (10 knots per hour) at 50 ft. ..	1/60	1/120	1/180
Steamers (20 knots per hour) at 50 ft. ..	1/120	1/240	1/360
Trains (30 miles per hour) at 50 ft. ..	1/150	1/300	1/450
Trains (60 miles per hour) at 50 ft. ..	1/300	1/600	1/900

At 50 ft. the exposure may be double that at 25 ft.

At 100 ft. the exposure may be double that at 50 ft.

OPTICAL CALCULATIONS.

FINDING THE FOCAL LENGTH OF A LENS.

As simple and accurate a method as any is first to focus the lens on an object at an infinite distance (see table on page 457), and to mark the position of any convenient part of the moving lens front on the fixed camera baseboard, then place any object such as a foot rule before the camera, and focus—by moving only (1) camera as a whole and (2) camera front on baseboard, not back of camera—until image on screen is same size as original. The distance through which the camera front has to be moved to secure this is the focal length of the lens, and is indicated by the separation of the mark on the fixed baseboard from that on the lens front in its final (same-size) position.

FOCAL DISTANCES WHEN COPYING ON A REDUCED SCALE.

When reducing an original x times (linear), distance from original to lens is found by *multiplying* focal length of lens by x and adding one focal length.

Example—Reducing 12 in. to 4 in. (reduction of 3 linear) with 6 in. lens, distance from original to lens is $6 \times 3 + 6 = 24$ in.

Distance from lens to plate is found by *dividing* focal length by x and adding one focal length.

Thus (conditions as above) $6 \div 3 + 6 = 8$ in.

FOCAL DISTANCES WHEN ENLARGING WITH CAMERA OR LANTERN.

When enlarging a negative x times (linear), distance from negative to lens is found by *dividing* focal length of lens by x and adding one focal length.

Example.—4 inches in negative to 16 inches in enlargement, that is x equals 4. With lens of 8 inch focus, distance from lens to negative is $8 \div 4 + 8 = 10$ in.

Distance from lens to sensitive paper or plate is found by *multiplying* focal length of lens by x and adding one focal length.

Thus (conditions as above) $8 \times 4 + 8 = 40$ in.

"CONJUGATES" AND "EXTRA FOCAL" DISTANCES.

The full distances: (1) lens to plate, and (2) lens to original, are called the "conjugate focal lengths."

Imagine a solid bar projecting in front of and behind the lens to a distance in each case equal to the focal length of the lens. The

distances from opposite ends of the imaginary bar to the original and plate respectively are the "extra focal distances" (E.F.D.). They are the conjugates less one focal length.

MENTAL LENS CALCULATIONS.

By using the "extra focal distances" lens calculations become much more readily done in the head, remembering that:—

When copying or enlarging, say, 4 times, the greater "extra focal distance" is four times the focal length of the lens, and the smaller "extra focal distance" one-fourth the focal length of the lens. Similarly for a 5-times reduction or enlargement, the greater E.F.D. is five times the focal length; the smaller, one-fifth the focal length.

By adding one focal length to each of these E.F.D.'s we get the actual distances from plate and original to lens.

STUDIO CALCULATIONS.

(By the E.F.D. Method.)

To calculate what length of studio is necessary for work of a given kind with a given lens, it is convenient to take the height of the average sitter as:

Full length standing	68 inches
Head and shoulders	30 inches

When making portraits in the sizes of prints in common use, the degrees of reduction are those given in the following table.—

Name and Size of Photograph.	C. de V.	Cabinet	Boudoir.*	Imperial.†
Height of image on photograph	3	5	7½	9
For full-length portrait, reduction figure is	23	13	9	7½
For head and shoulders portrait, reduction figure is	10	6	1	3 nearly

* 8½ × 5. † 10 × 6⅞.

These few figures and the E.F.D. rule given above are all that is required for the ordinary studio calculations.

Thus we want to know what descriptions of work can be done, say, in a studio 18 ft. long with a 10 in. lens, that is we want to find the reduction figure possible in these conditions.

In all calculations of studio working space 6 ft. ought to be subtracted from the wall-to-wall length. The sitter will usually be 3 ft. in front of the back wall, and the photographer wants about the same space behind the camera.

Therefore, working space is 12 ft. = 144 in.

Subtracting 2 focal lengths (20 inches), the space for the two E.F.D.'s is 124 ins. As the smaller E.F.D. is only an inch or so (a fraction of the focal length), it is near enough to take this 124 ins. as the front E.F.D. Dividing it by the focal length,

$$124 \div 10 = 12\tfrac{1}{2},$$

we get the reduction figure, showing that the greatest reduction we can get is not quite enough for full length cabinets.

Similar studio calculations are readily made, bearing in mind that the total wall-to-wall length is parcelled out thus:—

E.F.D. towards object (large).
E.F.D. towards image (small).
Two focal lengths.
Space for sitter and operator (6 ft.).

Remember, too, that the object E.F.D. is equal to the focal length × the reduction figure, whilst the image E.F.D. is the focal length ÷ the reduction figure, and is, therefore, never more than an inch or two at the most.

SHORTENING AND INCREASING THE FOCAL LENGTH OF A LENS.

The rule (very rough, on account of the impossibility of knowing from which part of a lens-mount to measure), for finding the focal length of an extra lens, to reduce or increase the focal length of a given lens, is:—

Multiply the focal length to be altered by the final focal length desired, and divide the product by the original focal length less the final focal length.

That is: $f_2 = \dfrac{f_1 \times F}{f_1 - F}$

where f_1 is the original focal length,
F the final focal length required,
and f_2 the focal length of the necessary added lens.

To increase the focal length use a negative lens
To reduce the focal length use a positive lens.

MAGNIFIERS

When using a supplementary lens (magnifier) as a means of bringing near objects into focus, the focal length of the supplementary lens must be equal to the distance of the object. This holds good whatever the focal length of the original lens.

TELEPHOTO CALCULATIONS.

F = equivalent focal length of complete lens.
f_1 = equivalent focal length of positive.
f_2 = equivalent focal length of negative.
E = camera extension, from negative lens to ground glass.
M = magnification, that is number of times the image given by the complete lens is larger than that given by positive alone.

Magnification when working at given extension is found by dividing camera extension by focal length of negative lens and adding 1.

$$M = \frac{E}{f_2} + 1.$$

Camera extension, necessary for given magnification—multiply focal length of negative lens by magnification less 1.

$$E = f_2 (M - 1)$$

Focal length of complete lens.—Multiply focal length of positive by magnification.

STEREOSCOPIC FACTS AND FIGURES.

To secure correct conditions of convergency each print must be seen under the same angle of view as that at which it was produced, and the two prints must be mounted in accord with the following rules:—

Let P = separation of any pair of corresponding points on prints.
N = separation of same points on negatives.
E = separation of eyes (average is 64 mm.).
L = separation of camera lenses.

A non-prismatic stereoscope being used:—

1. If image points represent infinitely distant objects, make $P = E$.

2. If only near objects are shown and an ordinary single plate double lens stereo camera has been used,

Make $P = E + L - N$.

3. If a single camera is used for two separate exposures, or if two separate similar cameras are used together, measure N with negatives placed edge to edge and in the same relative positions that they occupied during exposure, and then

Make $P = E - N +$ length of one plate.

If a prismatic stereoscope, fitted with properly centred half lenses is used, add the width of one prism to above values of P.

DIAPHRAGM NUMBERS.

EQUIVALENT F/- AND UNIFORM SYSTEM NUMBERS.

Rel. Exposure Req'd..	1	2	4	8	16	32	64	128
F Nos.	4	5·6	8	11·3	16	22·6	32	45·2
U.S. Nos.	1	2	4	8	16	32	64	128

NOTE.—Most lenses are now marked with the f/ numbers, although the U.S. numbers are used on Kodak lenses. Also the actual diameter of the diaphragm aperture in millimetres is marked on Zeiss lenses such as the "Convertible."

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. Welborne Piper, from "The First Book of the Lens."

FOCAL LENGTH, INCHES.	DISTANCE OF FOCUSSING-SCREEN BEHIND PRINCIPAL FOCUS.			
	$\frac{1}{100}$ in.	$\frac{1}{250}$ in.	$\frac{1}{500}$ in.	$\frac{1}{1000}$ in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11 ,,	28 ,,	55 ,,	110 ,,
3	25 ,,	63 ,,	125 ,,	250 ,,
4	45 ,,	113 ,,	225 ,,	450 ,,
5	70 ,,	175 ,,	350 ,,	700 ,,
6	100 ,,	250 ,,	500 ,,	1000 ,,
7	136 ,,	340 ,,	680 ,,	1360 ,,
8	178 ,,	¼ mile	½ mile	1 mile
9¾	264 ,,	660 yds.	¾ ,,	1½ miles
11¼	351 ,,	½ mile	1 ,,	2 ,,
12½	434 ,,	1085 yds.	1¼ miles	2½ ,,
13¾	525 ,,	¾ mile	1½ ,,	3 ,,
16	700 ,,	1 ,,	2 ,,	4 ,,
17¾	875 ,,	1¼ miles	2½ ,,	5 ,,
19½	1056 ,,	1½ ,,	3 ,,	6 ,,
21	1225 ,,	1¾ ,,	3½ ,,	7 ,,
22½	1406 ,,	2 ,,	4 ,,	8 ,,
24	1600 ,,	2¼ ,,	4½ ,,	9 ,,
25	1 mile	2½ ,,	5 ,,	10 ,,
28	1¼ miles	3¼ ,,	6½ ,,	13 ,,
30	1½ ,,	3¾ ,,	7½ ,,	15 ,,
33	1¾ ,,	4½ ,,	9 ,,	18 ,,
35	2 ,,	5 ,,	10 ,,	20 ,,

By focussing accurately on distances not less than those given, we ensure that the focussing-screen is within $\frac{1}{100}$, $\frac{1}{250}$, $\frac{1}{500}$, or, $\frac{1}{1000}$ in. from the true principal focus.

DISTANCES WHEN ENLARGING AND REDUCING.

Focus of Lens, inches	TIMES OF ENLARGEMENT AND REDUCTION.							
	1	2	3	4	5	6	7	8
	inches	inches	inches	inches	inches	inches	inches	inches
3	6 6	9 4 1/2	12 4	15 3 3/4	18 3 3/5	21 3 1/2	24 3 3/7	27 3 3/8
3 1/2	7 7	10 1/2 5 1/4	14 4 2/3	17 1/2 4 3/8	21 4 1/5	24 1/2 4 1/12	28 4	31 1/2 3 15/16
4	8 8	12 6	16 5 1/3	20 5	24 4 4/5	28 4 2/3	32 4 4/7	36 4 1/2
4 1/2	9 9	13 1/2 6 3/4	18 6	22 1/2 5 5/8	27 5 2/5	31 1/2 5 1/4	36 5 1/7	40 1/2 5 1/16
5	10 10	15 7 1/2	20 6 2/3	25 6 1/4	30 6	35 5 5/6	40 5 5/7	45 5 5/8
5 1/2	11 11	16 1/2 8 1/4	22 7 1/3	27 1/2 6 7/8	33 6 3/5	38 1/2 6 5/12	44 6 2/7	49 1/2 6 3/16
6	12 12	18 9	24 8	30 7 1/2	36 7 1/5	42 7	48 6 6/7	54 6 3/4
7	14 14	21 10 1/2	28 9 1/3	35 8 3/4	42 8 2/5	49 8 1/6	56 8	63 7 7/8
8	16 16	24 12	32 10 2/3	40 10	48 9 3/5	56 9 1/3	64 9 1/7	72 9
9	18 18	27 13 1/2	36 12	45 11 1/4	54 10 4/5	63 10 1/2	72 10 2/7	81 10 1/8
10	20 20	30 15	40 13 1/3	50 12 1/2	60 12	70 11 2/3	80 11 3/7	90 11 1/4
11	22 22	33 16 1/2	44 14 2/3	55 13 3/4	66 13 1/5	77 12 5/6	88 12 4/7	99 12 3/8
12	24 24	36 18	48 16	60 15	72 14 2/5	84 14	96 13 5/7	108 13 1/2

The table is used as follows:—Knowing the focal length of the lens to be used and the degree of (linear) enlargement or reduction, look up the figure for enlargement or reduction in the upper horizontal row, and carry the eye down the column below it until it reaches the horizontal line of figures opposite the focal length of lens in the left-hand column.

When *enlarging*, the greater of the two distances where the two lines join is the distance from lens to the sensitive paper or plate. The lesser is the distance from lens to negative, or picture being enlarged direct in camera.

When *reducing*, the distances are *vice-versâ*: the greater is the distance from lens to original, the smaller from lens to sensitive plate.

RELATIVE EXPOSURES WHEN ENLARGING (WITHOUT A CONDENSER).

New Times of Enlargements.	Time of enlargement for which exposure is known.											
	1	1½	2	2½	3	3½	4	5	6	8	10	12
1	1	⅔	½	⅓	¼	⅕	⅙	1/9	1/12	1/20	1/30	1/40
1½	1½	1	⅔	½	⅖	⅓	¼	⅙	⅛	1/13	1/20	1/30
2	2¼	1½	1	¾	½	⅖	⅓	¼	⅕	1/9	1/12	1/20
2½	3	2	1⅓	1	¾	⅗	½	⅓	¼	⅙	1/10	1/15
3	4	2½	1¾	1⅓	1	¾	⅔	½	⅓	⅕	⅛	1/11
3½	5	3¼	2¼	1⅔	1¼	1	⅘	½	⅖	¼	⅙	⅛
4	6	4	3	2	1½	1¼	1	⅔	½	⅓	⅕	⅐
5	9	6	4	3	2¼	1¾	1½	1	¾	⅖	⅓	⅕
6	12	8	5	4	3	2½	2	1⅓	1	⅗	⅖	2/7
8	20	13	9	7	5	4	3¼	2¼	1⅔	1	⅔	½
10	30	19	13	10	7	6	5	3⅓	2½	1½	1	¾
12	42	27	19	14	11	8	7	4⅔	3½	2	1⅓	1

To use this table find in the top horizontal line the number of times of enlargement for which exposure is known. Under this number the relative time of exposure for different degrees of enlargement will be found opposite the new times of enlargement in first vertical column.

RELATIVE EXPOSURES WHEN COPYING OR REDUCING.

New Scales of Reduction.	Scale of reduction for which exposure is known.											
	1	¾	⅔	½	⅓	¼	⅕	⅙	⅛	1/10	1/20	1/30
1	1	1⅓	1½	1¾	2¼	2½	3	3	3	3⅓	3½	3½
¾	¾	1	1 1/10	1⅓	1¾	2	2	2¼	2⅓	2½	3	3
⅔	⅔	⅞	1	1¼	1½	1¾	2	2	2¼	2¼	2½	2½
½	½	¾	⅘	1	1¼	1½	1½	1¾	2	2	2	2
⅓	4/9	4/7	⅔	⅘	1	1⅛	1¼	1¼	1½	1½	1⅗	1¾
¼	⅖	½	9/16	⅔	⅞	1	1	1⅕	1¼	1¼	1½	1½
⅕	⅜	½	½	⅗	⅘	1	1	1	1⅙	1⅕	1¼	1⅓
⅙	⅓	4/9	½	⅗	¾	⅞	1	1	1	1⅛	1⅕	1¼
⅛	⅓	⅖	4/9	5/9	⅔	⅘	⅞	1	1	1	1 1/10	1⅛
1/10	⅓	⅖	⅖	½	⅔	¾	⅘	⅞	1	1	1	1⅛
1/20	2/7	⅓	⅖	½	⅗	⅔	¾	⅘	⅞	1	1	1
1/30	¼	⅓	⅜	½	⅗	¾	¾	⅞	⅞	⅞	1	1

To use this table find in the top horizontal line the scale of reduction for which exposure is known. Under this scale the relative time of exposure for different degrees of reduction will be found opposite the new scales of reduction marked in first vertical column.

TABLE OF VIEW-ANGLES.

DIVIDE THE BASE* OF THE PLATE BY THE EQUIVALENT FOCUS OF THE LENS.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
0·282	16	0·748	41	1·3	66
0·3	17	0·768	42	1·32	67
0·317	18	0·788	43	1·36	68
0·335	19	0·808	44	1·375	69
0·353	20	0·828	45	1·4	70
0·37	21	0·849	46	1·427	71
0·389	22	0·87	47	1·45	72
0·407	23	0·89	48	1·48	73
0·425	24	0·911	49	1·5	74
0·443	25	0·933	50	1·53	75
0·462	26	0·954	51	1·56	76
0·48	27	0·975	52	1·59	77
0·5	28	1·0	53	1·62	78
0·517	29	1·02	54	1·649	79
0·536	30	1·041	55	1·678	80
0·555	31	1·063	56	1·7	81
0·573	32	1·086	57	1·739	82
0·592	33	1·108	58	1·769	83
0·611	34	1·132	59	1·8	84
0·631	35	1·155	60	1·833	85
0·65	36	1·178	61	1·865	86
0·67	37	1·2	62	1·898	87
0·689	38	1·225	63	1·931	88
0·708	39	1·25	64	1·965	89
0·728	40	1·274	65	2·0	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plate 3¼ × 4¼.

Diagonal is 5·3 inches. 5·3 ÷ 13 = ·407, corresponding with angle of 23°.

* More accurately the diagonal of the plate, inasmuch as the field of the lens is circular, and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate. The maker of a lens, stated to cover up to a given angle, may be asked if that angle is measured on the length or diagonal of a plate.

The lengths of the diagonals of the plates most commonly used are :—

3¼ × 3¼	diagonal	4·6	inches.	7½ × 5	diagonal	9·0	inches.
3¼ × 4¼	,,	5·3	,,	6½ × 8½	,,	10·7	,,
5 × 4	,,	6·4	,,	10 × 8	,,	12·8	,,
4¾ × 6½	,,	8·0	,,	12 × 10	,,	15·6	,,
7 × 5	,,	8·6	,,	15 × 12	,,	19·2	,,

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS WHEN SHARP FOCUS IS SECURED ON INFINITY.

Focal length of Lens in inches.	Ratio marked on Stops. Number of feet after which all is in focus.													
	f/4	f/5·6	f/6	f/7	f/8	f/10	f/11	f/15	f/16	f/20	f/22	f/32	f/44	f/64
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	15	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	[illegible]	14	11½	10½	7	5¾	3¾
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	6
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	23	27	22	20	13½	10	6½
7½	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	150	104	100	84	76	60	56	40	38	30	27	19	13½	9
8¾	156	111	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	131	113	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

If sharp focus is secured on any of the distances shown, then, with the stop indicated, all objects are in focus from half the distance focussed on up to infinity.

FOCAL LENGTH OF LENSES RECOMMENDED FOR STUDIOS OF VARIOUS LENGTHS.

The following table shows the focus of lens which is suitable for comfortable working in studios of various lengths. In each case it is assumed that 5 ft. of the length will be taken up by camera, operator, sitter and background. The figures in column 1 are the full run of the studio, including this 5 ft. In the case of the short studios the focal lengths are about the longest which can be used: in the case of the longer studios somewhat greater focal lengths might be used, but the lenses directed in the table are about the best for general work.

Length of Studio. Feet.	C.D.V. full length. Inches.	C.D.V. half length and Cabinet full length. Inches.	C.D.V. Lead, Cabinet half length. Inches.	Cabinet head and Boudoir full length. Inches.	Boudoir half length. Panel full length. Inches.	Boudoir head, Panel half length. Inches.
12	4*	6½*	8½	9*	12*	14
14	4½*	7½*	9	10*	13*	16
16	5½	8½	10	10½	16	18
18	6	8½	10½	10½	16	18
20	6	10	10½	12	18	20
22	7	10½	12	14	22	22
24	8½	12	14	16	24	24
28	8½	13½	16	16	24	24
30	10	13½	16	18	24	24

* Full lengths may be obtained with these focal lengths, but the standpoint is so near to the sitter that good perspective cannot be expected.